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VIEWS, NEWS AND INTERVIEWS.

A German electrician is said to have attached miniature incandescent lamps to the points of skates.

"Did you ever stop to think how many isolated electric plants there are in every large city that are owned and operated by men who know little or nothing of electricity?" asked a level headed business man. "These people know still less about the economical operation of their plants. Now, why wouldn't it be a good scheme for a consulting engineer to offer his services at, say, $25 a year, to the owner of each plant? He could make monthly inspections and his advice would be worth more than its cost to the owner."

The Austrian railway authorities have recently issued a circular to the private railway companies, urging them to make experiments with electric lighting in the coaches, with the view of replacing the present system of lighting by oil or gas.

In the construction of the big power tunnel at Niagara Falls 27 lives were sacrificed.

Previous to laying the new cable from Thirty-eighth street, New York, to Hunter's Point, L. I., the Metropolitan Telephone and Telegraph Company for three days had men at work dragging the river at this point for old cables. They found three that had been broken several years ago and pulled them up. Two had been severed by ships' anchors, and the anchors were still clinging to them. Besides the danger from anchors, submarine cables suffer from friction with rocks on the river bottom. The swift current of the East River causes a submarine cable to chafe a good deal on the rocks, and so a cable there must be unusually well protected.

Ground has been broken for the new electrical works to be built at Brinton, Pa., by the Westinghouse company.

The taking of testimony in the suit of the Adams Electrical Railroad Company against the Lindell Railroad Company was concluded at St. Louis on January 31 before Special Examiner John A. Robinson. The examination has been in progress two years and has kept a dozen attorneys busy. The Adams company charges the Lindell company with infringement on the patents controlled by Dr. Wellington Adams. The Lindell company uses the motors of the General Electric Company, and under its contract the General company has been fighting the case and paying the expenses. As many millions are involved, it will be seen that the case is one of more than ordinary interest. Examiner Robinson will turn over to the Federal Court 2,308 pages of printed testimony and 254 exhibits in the shape of models and drawings. It will take a good-sized wagon to deliver the load to Judge Ayers' court. The case will be tried in March.

The Pemaquid *Messenger* is spurring on the town of Bristol to loan the proposed electric railroad $10,000, and then go without pie till the debt is paid at the rate of a thousand a year. The town would better build the road and own it and be longer paying for it. Then it will have something for its money besides a good digestion.—*Lewiston, Me., Journal.*

Dr. Coleman Sellers, of Philadelphia, was in Pittsburgh last week to inspect the dynamos which have been contracted for with the Westinghouse company by the Cataract Construction Company, of Niagara Falls. He says enough has already been done to prove the entire feasibility of the project.

It is reported that the ordinance imposing a tax of $1 each on electric light, telephone and telegraph poles has been stolen from the office of the clerk of the common council at Scranton, Pa.

Westinghouse Electric and Manufacturing Company.

It is reported that the Westinghouse Electric and Manufacturing Company will begin the manufacture of its glass globes for the stopper lamp at its own works this week. The Westinghouse people are emphatic that the question of whether the Edison patent has expired or not, according to Judge Rick's Cleveland decision, is of no interest to them as they soon will be manufacturing in commercial quantity under the Sawyer-Man patents the glass stopper lamp, and at a cost which, they say, will be far below the present cost of the Edison lamp.

The New York Electrical Society.

This institution, founded in 1881, is the oldest existing electrical society in this country, and its usefulness is extending from year to year. The object for which the society was established is to afford all who are interested in electricity, whether as a science or as an art, an opportunity of coming together for interchange of ideas and to increase their knowledge by annual courses of lectures, which have been a feature of the society's work since its inception.

The meetings for the remainder of the season include papers on the following subjects, and, when practical, visits will be paid to various points of interest:—"Electricity at the World's Fair and Its Lessons," "Electrical Resonance," by Dr. M. I. Pupin; "Electrical Heating to Date," by W. S. Hadaway; "An Evening at an Electric Lighting Station," "An Evening at an Electric Railway Station," "Experimental Demonstrations with the Static Machine," by Dr. W. J. Morton; "Progress in Storage Battery Work," by C. O. Mailloux.

In order to attain the full measure of its usefulness, and to encourage beginners to associate themselves with it, the society makes no distinction whatever in the grade of its membership, to which any person interested in its work is eligible without examination of any kind as to his knowledge of the subject.

An invitation is extended to all amateurs, students, artisans, manufacturers and others interested in the progress of electricity to join the society and aid in its work. The annual dues to the society are $3, and the secretary, George H. Guy, 534 Temple Court, New York city, will furnish blank forms of application for membership on request.

MR. W. H. PREECE, F.R.S., THE EMINENT ENGLISH ELECTRICIAN.—SEE "NOTES OF A TRIP TO THE UNITED STATES."

Notes of a Trip to the United States and to Chicago—1893.

READ BEFORE THE INSTITUTION OF ELECTRICAL ENGINEERS, LONDON, JANUARY 25, 1894, BY W. H. PREECE, C.B., F.R.S., PAST PRESIDENT.

In 1877, together with Mr. H. C. Fischer, I made an official and thorough inspection of the telegraphic system of the United States and Canada, and the lessons of that journey were reported to this Institution on February 13, 1878. The results of that trip were the introduction of the telephone, the practical application of quadruplex working, the adoption of sound reading in our telegraph offices, the disappearance of the Morse recorder, and the more general assimilation of the methods of working in the two countries.

In 1884, as a member of the British Association, I again visited Canada, and made another tour through the States, reporting my observations to the Institution on December 11, 1884. The chief result of this second trip was the introduction of the multiplex system of working of Mr. Delany, now so much in use amongst us, and doing splendid service with many of our chief towns; hexode working, six messages in any direction are simultaneously transmitted between London, Brighton, Bristol, Birmingham, and other commercial centers. The telephone was found fully developed, and firmly rooted as an invaluable aid in domestic and business requirements. The electric light was making great advances, especially as the illuminant of public streets and ways, to the great advantage and safety of the public; but electric railways and the transmission of power were only just looming in the air in an extremely tentative and experimental stage.

Now I am able to report another tale of a 10 weeks' trip taken in August and September last over much the same ground, but with two *pièces de résistance* thrown in—a visit to the great "World's Fair," and the holding of an Electrical Congress at Chicago.

I.—TELEGRAPHS.

The telegraphic system in the United States is in the hands of two great private telegraph companies, the Western Union Telegraph Company and the Postal Telegraph Company.

The Western Union Telegraph Company,

which is by far the larger of the two, is a gigantic undertaking. It is a congeries of at least 500 other companies which have been purchased, absorbed, or amalgamated from time to time; and it is also closely connected with virtually all the railways in the States. This connection with the railway companies gives it a very prominent and commanding position over its rival. In order to show the progress made since 1884, and the present condition of the business, I give the following table:

Particulars.	1884.	1893.	Great Britain, 1892.
Miles of poles and cables	145,037	189,936	33,680
Miles of wire	450,571	769,201	207,231
Offices	13,761	21,078	8,537
Messages	42,076,226	66,591,858	72,302,556
Capital	$80,000,000	$123,000,000	£10,130,820
Receipts	19,632,940	24,978,442	2,486,791
Expenses	13,022,504	17,482,405	2,470,839

The Postal Telegraph Company is a very much smaller concern. It has virtually come into existence since my previous visit, for when I was last in the States it had just commenced its operations, and it only possessed 1,500 miles of line and 4,260 miles of wires. It is a company which has been promoted, not so much to attack the Western Union Company, as was the case with all previous competing lines, but to establish a collecting company for the cable business, which is in the hands of the Commercial Cable Company. The present position of the Postal Telegraph Company is as follows:

Miles of line	15,997
Miles of wire	99,664
Offices	2,664*
Messages	9,335,291

The enterprise in telegraph work is evident at once on landing in New York. Every passenger on landing at the dock stage is approached by a messenger from one or both companies, soliciting messages; and on all the stages, except that of the Cunard Company, one or other of the telegraph companies has succeeded in establishing an office. The business done at these offices is very great, as, when facilities are thus given to passengers to send messages, nearly everyone wires home his or her safe arrival. This enterprise is evident everywhere. The blue and white sign of the Western Union Company, which is extremely prominent, is found in every hotel, at all railway stations and in large cities, and is as abundant as the post office sign is in England. At Long Branch, the Brighton of New York, where I spent two or three very pleasant days, there were no less than 19 offices belonging to the Western Union Company, and all paying.

There were 20 offices in the World's Fair alone, and 70 hotels in Chicago have Western Union offices in them.

Competition is intense, but there is no war of rates. A general tariff has been agreed upon, and the only rivalry that exists is in the collection and transaction of business. Dividend-earning being the chief end aimed at, only paying commercial stations are properly served. Social and domestic telegraphy is practically ignored, and sparsely populated districts are very inadequately provided for. Hence, in the United States telegraph business is neither so general nor so cheap as it is with us. The average price received per message is 15¾*d.*, as against 7.7*d.* earned by us. On the other hand, however, it must be remembered that their mean distance is far in excess of ours.

Construction of Lines.

I inspected considerable lengths of the line work constructed by each company, and drove over many miles of a new road line passing through Connecticut.

In this direction American electrical engineers have been very much behind us. They have not built their lines so solidly, nor have they followed true engineering principles in the same way that we have.

As a rule, their old lines are extremely irregular, being badly constructed with poles that we in England would not look at. But recently, owing to the difficulty in finding fresh routes, the growth of the number of the wires, and to the absolute necessity for accuracy of workmanship for securing silence on telephone lines, great improvements have been made, and some of the trunk lines put up by the telephone companies, and the new trunk line put up by the Postal Telegraph Company, will compare very favorably with our best modes of construction.

The telephone line to which I have alluded above consists of 16 arms, each carrying 10 wires, or 160 wires in all; the poles are 60 feet high, and are placed 100 feet apart. The arms are of pine, and their scantling is three and one-quarter inches by four and one-quarter inches, and they are 10 feet long. Owing to the use of wooden pins they are bored with holes one and one-half inches in diameter. This weakens the arm, and I observed two instances where arms were broken. A six foot arm bored for four insulators costs 15 cents, which is very cheap compared with the price we pay. But they are undoubtedly weak, and not to be compared with the oak arms that we use.

As a rule, the poles number 40 to the mile. They are generally of cedar, but sometimes of chestnut. The cedar poles come from Canada and Michigan. Each 25 foot cedar pole costs $2.25, and is said to last 15 years without preparation. The chestnut pole is a little cheaper, and it lasts only 10 years. It is extremely irregular in shape.

American engineers do not adopt the same plan that we adopt in the erection of arms. They are fixed any way, but generally on the modern lines they alternate on each side of the pole. This is done under the impression that it adds strength to the line. I do not know why it should. (We invariably fix the arms on that side of the pole facing London.) Every fifth pole is earthed as a protection against lightning. (We earth-wire every pole.) Stays are very little used indeed, but on new lines they have longitudinal stays in the direction of the wires, one end being fixed at the foot of one pole, and the other end at the top of the next pole. These are called "head guys," and are frequent. Iron poles are used only for electric railways. These are very substantial and look very well. They are made in three sections of simple iron tubes, either 6, 5 and 4, or 5, 4 and 3 inches in diameter respectively.

Pole roofs are not used as with us, but the poles are tapered off to throw off the rain.

Neither the Western Union nor the Postal Telegraph Company adopt any system for preparing their timber to resist decay. My attention had been called to a system of artificial seasoning called "wood vulcanizing," and it was reported that this system had been adopted by the Western Union Company. I found this was not true. The Western Union Company had experimentally tried the system on some wooden troughing employed for the protection of their pneumatic tubes underground, but the process was so expensive and the advantages so doubtful that they do not apply it to their poles or their arms.

Copper wire is very much used on telegraph and telephone lines. I saw in the Exhibition at Chicago a form of wire called "tempered copper." This is said to be extremely strong and hard, but it is evidently an alloy of copper, for its resistance is high. I was surprised to find that a compound wire 1.7 ohms resistance per mile, put up by the Postal Telegraph Company in 1883, is still in use, and working well. Our experience of the durability of this wire was disastrous.

Underground Work.

Underground work was scarcely started in the States in 1884, but now, owing to peremptory legislation on the part of the municipalities, it has made very rapid progress. Underground work in the cities of the States has become general, with great advantage to the public, and also, as they have come to acknowledge, to the companies themselves. The only exception to this rule that I heard of was at Boston, where complaint was made that their underground system had been much disturbed by "wash-outs." These "wash-outs" are freshets, or great floods, tearing up the line and carrying away the pipes and wires.

The system of underground work adopted by the telegraph companies in America does not differ much from that adopted by us, excepting that they do not use gutta-percha, owing to its high price. They are using very largely a cable similar to the Fowler-Waring cables, and also kerite-covered wire. Kerite is a form of vulcanized india-rubber.

Offices.

Not much change has been effected in the mode of fitting up offices. Glass of the best quality is used very much indeed; doors, partitions, boxes for the collection of messages, are all made of thick glass. This looks very clean and nice, and is certainly effective.

There is an extremely efficient mode of collecting and distributing messages in the Western Union offices at New York and Chicago. Endless cords are kept in motion by means of small electric motors, and these cords transport small metal carriers somewhat similar to those we use in our pneumatic tubes. Before leaving New York I saw an improvement on this by which messages can be picked up as by the finger and thumb from the desk in front of each operator. They also have in use a system by which messages, envelopes, slips, etc., are conveyed by broad continuous leather belts, eight inches wide, kept in rapid motion by motors, and upon which the messages, etc., are laid, and carried to the point desired.

Each company has adopted a uniform and pretty-looking box for its office in the hotels. American hotels differ from ours in this: The hall of an hotel is usually open to the public, and no hotel that I entered was unfurnished with a telegraph office. I have mentioned that there were 70 hotel offices in Chicago. In fact, hotel proprietors court the presence of a telegraph office. Space is usually accorded free, and board is also provided for the operator. In some places, like the Palmer House Hotel, at Chicago, which is a great business center, a very high rent is demanded; but, generally speaking, no rent at all is paid. At the hotel I stayed at in Chicago—The Lexington—each company had an office in the hall; the rivalry that exists between the two companies taking the form of each striving to work with the louder sounder. The louder was that of the Postal Telegraph Company, and when I asked the operator why he allowed his instrument to make such a row, he replied, "We must beat the Western Union Company anyhow."

At Fort Sheridan, a military station about 20 miles away from Chicago, the Western Union Company opened an office, although the place contained only 1,000 soldiers. The office was worked by the soldiers, and I was assured by the company that they found it paid well.

The common system in the States is to tile the floors of their telegraph galleries and not to board them. Fireproof channels, or conduits fitted with slate tops, are arranged about the office for the distribution of the wires. Lockers for coats and hats are roomy and well made, and ample in the supply. At Chicago they are of open ironwork, very neatly made, six feet six inches high, and 28 inches by eight inches in sectional area. Four men, each of whom is supplied with a key, use such a locker. Great advantage is said to arise from the use of these open lockers in wet weather, and they are worth our own consideration.

The use of bicycles for messengers is very prevalent in the States.

Batteries at all the principal offices in the United States are gradually disappearing. The current for working the circuits is being supplied from dynamos, or from the electric lighting mains. In New York from 30,000 to 40,000 cells have been replaced by dynamos. At Boston 10,000 cells, which cost probably £4,000 per annum to maintain, have been replaced by current derived from the electric light mains at a cost of £600 a year. It must be remembered that the American telegraph circuits are worked entirely on the closed-circuit system. They use immense cells, and their cost of maintenance is excessive. We cannot compare their system with ours in this respect, for we use open circuits; and the maintenance of our batteries is certainly, cell for cell, not more than one-fourth or one-fifth that of the United States form of battery.

In New York the Western Union Company have a special plant of 51 small dynamos. In Chicago they have 46. The Postal Telegraph Company in New York are also using dynamos, and in their new station, which is being built, they are supplying what they believe to be an improvement on the system adopted by the Western Union Company.

We have shown in England that the use of dynamos, owing to the variation of current, is not suitable for high-speed working, and I much prefer the plan that we have adopted with so much success in working our Continental circuits—namely, the use of accumulators. Accumulators have an immense advantage over dynamos: they store up energy, so that in the event of any accident or breakdown of machinery the accumulator maintains the circuits working. The accumulator is not in motion. There is no machinery to fail or to break. There is nothing to stop, and little to get out of order. But the chief advantage of the accumulator is the absolute steadiness of its voltage. There is also economy in capital expenditure, and I am quite convinced that the Western Union Company in New York would have effected considerable economy if they had used accumulators charged by the electric lighting plant, instead of supplying the elaborate series of engines and dynamos now working their circuits direct.

At Boston and other stations a very well-made and well-designed motor-dynamo is supplied by Messrs. Crocker-Wheeler. They are primarily motors worked on the 110 volt electric lighting service, driving a small dynamo, and they transform this down to a voltage which will charge any number of cells required. This system is in use by all the telephone companies, and, as I will point out when speaking of telephones, the service is much improved by the use of accumulators thus charged.

Apparatus.

I observed little or no progress in the form of apparatus used. In neither company has there been any advance made on the systems in use in 1884. Duplex and quadruplex working are principally relied upon, while on the long-distance lines Wheatstone working is gaining ground, and being much more used. The only novel mode of working that was brought to my attention was a system of working cables automatically. This system has been threshed out by Mr. Wilmot, at Waterville, and adopted by the Commercial Cable Company, but it has been very much improved upon by Mr. Delany, the inventor of our multiplex system.

Typewriters have become quite common. The rule is for an operator to have his own machine. The Postal Telegraph Company use this system more than the Western Union Company. The latter company employ it invariably for their Wheatstone and other news circuits, but the Postal Telegraph Company use it very largely on all circuits; and I watched many operators taking off messages by ear and typeprinting them at the same time, and in all cases the typewriting machine held the sounder well in hand as regards speed.

The working of the Wheatstone system between New York and Chicago is admirable. The grand total of messages handled in one day on this circuit is certainly astonishing; 4,211 messages have been passed between these two places on one circuit in a day—a number that we can scarcely hope to rival.

The reason for this is not the greater speed at which the apparatus is worked—for the speed is less than ours—but to the fact that the business day in the United States extends over a much greater number of hours than with us. The business day in New York commences three hours before that in San Francisco, and the business day in San Francisco extends for three hours beyond the business day in New York. Hence the business day, which in England scarcely extends telegraphically to four hours, in the United States extends probably to 12 hours. Thus the number of messages handled is much greater per day than with us.

The advantage of Wheatstone working to the company was illustrated while I was there. On August 29 a cyclone in the eastern part of the States prostrated the poles and wires for miles throughout half a dozen States. Three Wheatstone circuits were maintained working—and working badly—between Chicago and New York by means of repeaters at Buffalo and Pittsburgh, but on these three circuits 8,693 messages were handled. This was the only means of telegraphic communication between the eastern and the western States. Curiously enough, the new and strong long-distance telephone line was not broken down.

On August 18, while I was there, I took down as having been sent between 8 A. M. and 5.30 P. M.—forwarded, 1,272; received, 1,889. This work was handled on two circuits, with an average speed of 190 words per minute.

The Wheatstone system in the States is much more extensive in the West than in the East. It is giving such good service that it will probably receive considerable additions this year.

It must be remembered that between Chicago and San Francisco we are dealing with a distance of 2,500 miles, and on this circuit they were working when I was there at the rate of 110 words per minute.

I observed a very high rate of working on some of the quadruplex circuits. I took down these figures at Boston:

Forwarded	686
Received	521

This was an ordinary day's work. On another circuit, between 8.30 A. M. and 11.30 A. M., in Buffalo, the numbers were:

Forwarded	126
Received	140

on one side of the quadruplex only.

I noticed at the Chicago Exhibition, in the French Exhibit, a new adaptation of multiplex working by Mons. Mercadier, who showed in operation 12 working sides. But the working, although interesting, was poor. The reading was done by telephone, and each branch was selected by the sounding of a particular note. The apparatus is not yet in anything approaching a practical stage, but for short lines something may some day come out of it.

(To be concluded.)

* Of this number, 860, or nearly one-third, are situated out of the States, in Canada and elsewhere.

TELEPHONE NEWS AND COMMENT.

The Telephone Girls all Like Mr. Bethell.

The telephone girls in New York have their troubles like the rest of humanity. One of them was interviewed recently and gave vent to her feelings as follows:

"You see, we are now prohibited from conversation during all business hours, and you know it is just like being locked up in prison if you can't say a word now and then. But that is not all. An order has gone into effect promoting several of the girls to the position of supervisors—spies we call them—whose duty it is to report to the superintendent any delinquencies on our part. That we consider the worst of all. If these girls could only see the looks we give them behind their backs some time they would feel mighty mean I can tell you."

"Was it Mr. Bethell, the new general manager, who has put these into force?" she was asked.

"Yes; it was Mr. Bethell," replied the operator, her face brightening up, "but don't you dare say a word against him. He is one of the nicest men in the world, and we all love him. He has such a handsome blonde beard and sympathetic blue eyes, and he treats us like perfect ladies. He has such a sweet, soft voice, too. He would never have thought of those rules if it hadn't been for a nasty operator who came from Chicago and told him how they managed their operators out there."

Telephone talk is now more like the old kind—cheaper.—*Manchester Union*. Where?

The Western Telephone Construction Company is reported to have formed an alliance with some of the officials of the Postal Telegraph Company.

The Bell telephone patent has expired, but the company wants to increase its capital stock by $30,000,000. This does not indicate that it intends to ring off.—*Indianapolis News*.

The fight over the Berliner transmitter, in the suit brought to annul by the government, will be resumed this Summer, and it is to be hoped that a decision will be promptly reached.

General Superintendent D. I. Carson, of the Southern Bell Telephone Company, should commence the sale of receivers in his territory. There is a great demand for them in the South.

The druggists of Milwaukee are having a fight with the telephone company. They want their telephones for the unrestricted use of their customers. Naturally, the company doesn't see it that way.

The price of telephone receivers as we go to press is $1.25 each. But when you buy one don't imagine that you have a complete telephone exchange with its far-reaching service at your command. On the contrary, quite the reverse.

There is strong opposition in Boston to the granting of the additional capital of $30,000,000 asked for by the American Bell Telephone Company. If the request of the company is refused it is reported that it will remove to New York.

The coming rivals of the Bell Telephone Company might as well make up their minds that they've got a hard row to hoe. The Bell Company hasn't been expending millions on its plant everywhere for a score of years for nothing. It is all ready for the fray.—*Boston Herald*.

Attorney Edward Kibler, of Newark, O., has prepared a bill for the Ohio Legislature pertaining to the establishment, ownership and control of telephone exchanges by municipalities. Since the Bell patent has expired, Mr. Kibler thinks that Ohio cities may now own their telephone systems as well as electric light plants.

The Mayor of Boston is said to be sharpening his teeth for a fight with the New England Telephone Company over the question of rates. The Mayor will also endeavor to make it interesting for the electric light company on the same question. Messrs. Keller and Gilbert will now have a chance to show of what stuff they are made.

A letter to a friend in this city contains Mr. John Wanamaker's statement that he is not in the telephone business. But there are several persons who believe that Mr. Wanamaker is contemplating such a venture, and with the knowledge and experience he acquired as Postmaster-General he would at once be recognized as a very strong and important factor in opposition to the Bell interests.

The Common Council, of Oconto, Wis., is conferring with G. M. Jarvis, of Chicago, who is looking for a location to erect a plant for the manufacture of telephones. One of his propositions is that in consideration of the city's giving him a bonus of $10,000 he will build a $30,000 telephone factory, employ 100 men and women, and at the expiration of five years, shou'd he fail in his undertaking, the $10,000 bonus will be returned to the city. No decision had been reached at last accounts.

The Harrison Telephone Company, of Missouri, is to be organized at St. Louis as a branch of the Harrison International Telephone Company, of Chicago. It promises to supply a much improved telephone at a rental which will not exceed $1 per month, and perhaps be even lower. At a meeting held several days ago Stephen B. Elkins was elected president; S. M. Ferree, of Kansas City, vice-president, and Patrick Egan, late United States Minister to Chili, secretary. The Northern Trust Company, of Chicago, will act as treasurer. At $1 per month there should be a rush of subscribers to this company—if it can give the service.

A Strong Company.

THE MATHER ELECTRIC COMPANY REORGANIZED.

The Mather Electric Company, of Manchester, Conn., has been reorganized, and will be backed in future by a syndicate of Hartford capitalists. Some new names have been added to the board of directors, and M. S. Chapman has been elected president, T. C. Perkins, vice-president and J. L. Bunce secretary and treasurer. The company is now on a solid footing, and the sale of their well-known dynamos and generators will be pushed actively in both the electric lighting and street railway fields. Their factory is now running full time with a portion of its force, and it is expected that they will be in a position shortly to furnish employment to 200 or 300 men.

The directors of the company are Charles E. Perkins, T. C. Perkins, M. S. Chapman, Henry A. Redfield, Charles M. Jarvis, John L. Bunce, Norman M. D. Crawford. The new officers have engaged as superintendent of the electrical and manufacturing departments Theodore Gonet, an electrical engineer who is at present with the Westinghouse Electric and Manufacturing Company of Pittsburgh. He will have associated with him W. E. Powell, who is now with the Mather Company. The company starts out under the reorganization free from debt and with sufficient working capital.

Electric Lighting of Public and Private Conveyances in London and Paris.

The United States being such a country of electricity, it surprises most persons who have passed part of their time in the European capitals, and arrive at New York (*the* representative city of North America) to find that electricity has not yet entered any private vehicles here so far, and where horse-power is employed for street cars, nothing more than a dingy smelling petroleum lamp is used for lighting the conveyance. The London omnibus electric light is fixed in a globe, smaller and flatter than the pattern which screens the oil lamps in a railroad car. The incandescent carbon hangs downward, contrary to a table lamp, and is contained within a very small bulb. Behind the electric lamp there is a concave reflector of enameled iron. There are no restrictions as to form of the lamp used in the trams, as the same conditions do not apply, but in the cab lamp, where economy of space is a consideration, the globe, contained in a semi-circular reflector having a glass front, is placed upright at the back of the vehicle, over the passenger's head. For the present the actual outlay upon plant and cost of working 'buses, etc., fitted with the cheapest form of electric lamp is not ascertainable.

The first electric lighted carriage in Paris came out about a year ago and was tried with very satisfactory results. The enterprising coach firm, H. Royer & Company, of Paris, used the Julien system of two side incandescent lamps and one for an inside lamp. Power of light given was equal to four carriage candles (per lamp) with maximum of 1.2 ampere per hour, lasting for 12 consecutive hours. Since then and up till now electric carriage lighting on the English side of the Channel has progressed at a much faster rate and has now reached a state of supremacy, of which I give here some of the most important remarks upon, for it should not be long before an improvement is made on better lighting of American carriages of all classes, undoubtedly making more work for some trades and a benefit to the carriage riding fraternity.

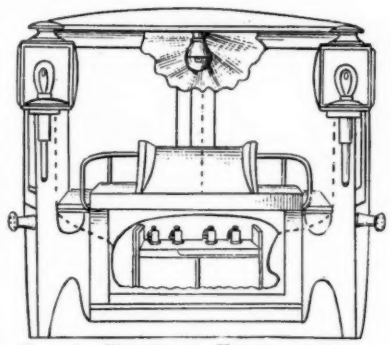

FIG. 1.—BROUGHAM FITTED WITH ELECTRIC LAMPS.

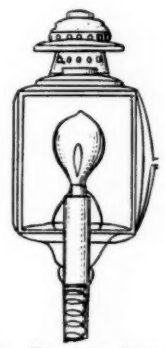

FIG. 2.—ELECTRIC CARRIAGE LAMP.

Here is a front view shown, Fig. 1, of the brougham fitted out with electric lamps. An eight or four cell storage battery is carried in a box about eight inches long, four inches wide and seven inches deep in the boot under the coachman's seat, and the same battery can be so arranged as to supply two outside lights and that of the interior. With eight storage batteries a current is obtained to keep the three lamps going, each at an equivalency of seven candles for 18 consecutive hours. The cost of recharging varies, according to wear and tear, from two to five shillings (50 cents to a dollar), not more than the expense entailed by the use of candles or oil, which in any closed vehicle give out an unpleasant odor. The lamp itself does not wear out unless subjected to careless treatment or weakened by the application of too strong a current, the accumulator, however, making the latter contingency almost an impossibility. An india rubber socket is employed in the outside lamps so as to reduce the vibration of the carriage.

F. W. N. K.

Decision Against The Davis Electrical Works.

The General Electric Company issued a statement last Saturday to the effect that on February 9 a decision in favor of the Edison Electric Light Company on the appeal of the Davis Electrical Works, of Springfield, Mass., from the decision of Judge Colt, enjoining them from repairing Edison incandescent lamps, was rendered by the United States Circuit Court of Appeals.

ELECTRIC LIGHT CONVENTION.

A Highly Successful Meeting Presaged at Washington, D. C., February 27, 28 and March 1.

AN INTERESTING PROGRAMME HAS BEEN ARRANGED, AND A WIDE RANGE OF DISCUSSION OUTLINED—THE SPECIAL TRAIN FROM NEW YORK WILL CARRY OVER 100 PERSONS—A LARGE ATTENDANCE EXPECTED FROM THE WEST.

The invitations sent out by Secretary Geo. F. Porter to the electric light and electric railway men of the country have borne good fruit in the line of favorable responses. It is now evident that the attendance will be quite large, and that there will be much of interest and value to discuss.

A number of manufacturers have decided to exhibit, and several new electrical inventions particularly interesting to the electric lighting fraternity will be shown. Arc lamps for incandescent circuits will form a leading feature of the exhibit. Everyone who can possibly get to Washington should make it a point to be present. The convention begins on Tuesday, February 27, and will continue for three days. An excellent programme has been arranged for the convention hours, and the local committee on entertainment is planning to have the balance of the time devoted to sight-seeing in this most entertaining and historical city.

THE PROGRAMME.

At a recent meeting of the Committee on Programme the following list of topics and speakers was considered and arranged. Meetings of the Executive Committee will probably be held immediately upon the adjournment each afternoon:

TUESDAY, FEBRUARY 27, 1894.

Meeting of the Executive Committee at 9 A. M., Parlor 36, Ebbitt House. Morning session, 10.30 o'clock, Grand Army Hall. Address: President E. A. Armstrong.

Reports of Committees on Legislation, C. H. Wilmerding, chairman; on World's Columbian Fair, B. E. Sunny, chairman; on Relation between Manufacturing and Central Station Companies, F. Nicholls, chairman.

Afternoon session, 2 o'clock—Reports of Committees on Data, H. M. Swetland, chairman; on Finance, John A. Seely, chairman; on Underground Conduits and Conductors, M. J. Francisco, chairman; on Rules for Safe Wiring, William J. Hammer, chairman.

Paper by E. A. Leslie: "Impressions of a Central Station Man Abroad."

WEDNESDAY, FEBRUARY 28, 1894.

Morning session, 10 o'clock—Paper by J. H. Vail: "The Importance of Complete Metallic Circuits for Electric Railways."

Topic—Electrolytical Effects of Return Currents.

Topic—Storage Batteries.

Afternoon session, 2.30 o'clock—Paper by A. B. Herrick, "Development of Switchboards for Modern Central Stations."

Topic—What is the Most Economical Size for Arc Dynamos? Discussion by Charles R. Huntley, George Redman, E. F. Peck, G. H. Blaxter, H. H. Fairbanks.

Topic—Underground Circuits. Discussion by George W. Plympton, H. J. Smith, C. H. Wilmerding, M. J. Francisco, John A. Seely.

Topic—How to Rate Arc Lamps. Discussion by James A. Ayer, C. F. Hesser, A. J. De Camp, E. W. Rollins, George R. Stetson M. A. Beal.

Evening session, 8 o'clock—Paper by T. C. Martin and L. Stieringer: "Electric Lighting at the World's Fair and Some of its Lessons, Illustrated with Stereopticon."

THURSDAY, MARCH 1, 1894.

Morning session, 10 o'clock—Paper by Chas. F. Scott: "Polyphase Transmission."

Topic—Arc Lights on Incandescent Circuits. Discussion by C. L. Edgar, L. B. Marks, J. T. Ridgway, W. S. Barstow, Thomas Spencer, Jno. C. Knight, Frederic Nicholls.

Topic—Meters vs. Flat Rates. Discussion by Chas. E. Scott, J. D. Barth, W. J. Greene, J. J. Burleigh, J. Gynne, J. J. Moore.

Topic—The Alternating Motor. Discussion by Nikola Tesla and others.

Afternoon session, 2.30 o'clock—Executive session.

Reports of Secretary and Treasurer and Executive Committee. Election of officers.

Mr. Perry Wins the John Scott Legacy Medal.

The Franklin Institute has awarded to Mr. Nelson W. Perry, the well-known electrical engineer and journalist, the John Scott legacy medal and premium for his system of series electric traction. An abstract of the report of the committee on awards follows:

Without entering into the discussion of the relative merits of the series and multiple arc systems of railway electric traction, which may well be assumed to be affected by the circumstances of their use in urban, suburban, interurban traffic and of the need for extension of lines beyond the originally planned limits, it may be said that the very ingenious system presented by Mr. Perry seems to be well worked out in detail and appears to overcome the difficulties arising in previously suggested series systems. Both the series and the usual multiple arc systems have their advantages and their disadvantages; while the former will not, nor is it intended to, replace entirely the multiple arc system at present in use, it has very decided and indisputable advantages in special cases. Its principal field of usefulness is in long lines, and the present introduction of electric railways leads to the belief that such long roads will soon become very numerous. As far as can be determined of a thing which exists so far as the knowledge of the committee extends, only on paper, and subject to the risks which invariably attend reduction to practice in the opinion of the committee, a railway may be practically operated by the series system under Mr. Perry's plan, and with the safety due to a perfectly served and constantly signaled block system about which there can be no mistake, for the current which drives the car not only sets the signal but refuses to work when two cars come on the same block.

The Institute, therefore, recommends the award of the John Scott legacy, premiums and medal to Nelson W. Perry for his system of series electric traction.

Electric Lighting at Rock Island.

Negotiations which have extended over a considerable period, and which have been practically settled for some days, were finally consummated Saturday afternoon, January 15, and that night S. M. Hamill, the general manager of the Brush Electric Company, of Cleveland, Ohio, left for his home, after having turned over his entire interest in Rock Island, including both electric and gas illuminating plants, to the People's Power Company, of Rock Island. Mr. Hamill purchased the entire stock and bonds of the gas company and the entire stock and bonds of the electric light company a year or two since. The two were consolidated. The purchase was made in the interest of the Brush Electric Company, of Cleveland, Ohio. The companies have been operated very successfully since.

The People's Light and Fuel Manufacturing Company, of Moline, owned and controlled the gas company and the electric light company of Moline. The Moline companies had run their gas mains and their electric light wires into Rock Island. The Rock Island companies retaliated. This led to considerable competition and an ultimate consolidation of the four companies. The People's Power Company, a new company which was recently organized, purchased the entire stock and bonds of the above four companies. The capital stock of the new company is $300,000.

S. M. Hamill retires as president and C. H. Deere, of Moline, was elected in his place. S. S. Davis, of Rock Island, and C. O. Nason, of Moline, were elected secretary and treasurer, respectively. A large new electric light station is being erected on the water power between Rock Island and Moline. The Moline and Rock Island electric light stations will be abandoned and the apparatus moved into the new station. A large new gas plant will also be built near the electric light plant and the old gas plants abandoned, so that Moline and Rock Island will have an entirely new outfit in the way of gas and electric light plants.

R. H. MacMullan, the manager of the Brush plants in Rock Island, remains with the new company. The new company have purchased a large amount of electric lighting apparatus from the Brush electric company for their new station.

The city of Moline has owned its own electric light plant for a number of years. The operation of the plant by the city was not considered an economical method of lighting, and they recently sold their plant to the new People's Power Company and made a contract with them for lighting the City of Moline for a period of two years. The City of Rock Island also made a contract with the new company for two years' lighting.

The Present Condition of Telephony.

Just now, when, by the expiration of the second Bell patent, a large number of electrical firms are ready to exploit this new branch of electrical work, a statement of the growth of telephony in the entire civilized world may be of interest to the would-be manufacturer of telephones and telephonic appliances. Although it is true that "liars will figure," figures don't lie, and a careful inspection of the subjoined table cannot help to be instructive to the shrewd Yankee par excellence man of business.

It will be noticed that the United States leads the world in telephony, the number of conversations transacted amounting to the grand total of 600,000,000, against 242,264,955, the highest European, or rather, German, number of telephone conversations. On the other hand, the average number of daily conversations per subscriber is greater in Germany than in the United States, the former being 7.7, as against 6.5, the American average. By taking account, however, of the number of inhabitants of the several countries, it is apparent that Switzerland and Sweden are the leading nations as regards the use of the telephone. In Germany the ratio of subscribers per 1,000 inhabitants is 1.72, with an average number of lines, 0.008. In Switzerland the same method of computation results in the astonishing fact that there is one subscriber per 800 inhabitants, as well as one line for each 150,000 people.

We take the subjoined table of the World's Telephonic Progress for 1892 from one of our valued European exchanges, the *Journal Télégraphique*. The figures are based upon such official statements as were published during the year 1893. Nevertheless they show to a certain extent the rapid development of telephony up to the 1st of January, 1893:

Country.	Cities having Exchanges.	Telephone Cond'r Mileage.	No. of Subscribers and Public Stations.	No. of Urban and Interurban Conversations.	Average per Subscriber per Day.
Germany	391	166,610	86,524	242,264,955	7.7
Austria	61	8,530	2,283	1,797,055	2.2
"	11	49,438	10,622	21,017,596	5.4
Hungary	14	6,796	2,991	8,379,585	7.7
"	9	1,079	964	1,510,918	4.3
Belgium	4	1,947	453	417,167	2.6
"	12	13,000	7,528	1,756,238	0.7
France	207	82,484	23,339	20,774,885	2.5
Luxembourg	49	1,973	1,113	1,594,629	3.9
Netherland	15	1,581	4,054	7,171,274	4.9
Russia	18	6,101	2,253	3,153,560	3.9
"	11	15,437	5,162	7,711,087	4.1
Sweden	288	29,528	12,447	28,187,420	6.3
"	178	35,617	15,211	23,516,241	4.3
Switzerland	135	32,836	14,610	8,138,160	1.6
Tunis	2	378	179	170,500	2.6
Australia (Meridinal)	7	3,411	803	.....	...
Cochin China	7	13	18	.....	...
British India	254	2,677	484	.....	...
"	4	1,240	1,003	1,587,340	4.4
Japan	4	5,204	1,528	3,191,917	7.1
New Zealand	22	3,160	3,811	25,698	0.1
Senegal	2	68	40	21,185	1.3
Victoria	11	3,005	2,420	.....	...
Americal Bell Tel. Co.	850	500,000	256,000	600,000,000	6.5
Total	2,560	972,113	455,852	982,387,416	

Hypnotism by Telephone.

The Russian remained in the office of a local newpaper, "called up" a beer garden in Milwaukee, commanded certain persons to "fall asleep," and four persons, three women and a man, "remained under the spell for exactly seven minutes, when they were released" by the Russian's commands.

The gifted editor of the Chicago *Record* thinks there is nothing about this which passed the ordinary, as it does not take so very much to put Milwaukee people to sleep at any time, and in a beer garden the conditions are even more favorable. He suggests that the talents of that wild, weird Russian are misdirected, and intimates that a more noble work, for which the nation would call him blessed, is to hypnotize the telephone girls and obtain that subtle mastery over them which he claims to be able to secure, then galvanize them into life, direct them from the recesses of his mighty brain to give the number he calls for within an hour or two, and not come back with a rasping "Busy-now-call-them-again-'boyd-an-n-n-swer-'body answer?" which seems to this gifted editor's warped mind to constitute the entire vocabulary of those unseen, mysterious girls.

ELECTRIC RAILWAY AND POWER NOTES.

The Avondale Street Railway car sheds and machine shop at Cincinnati were burned on February 2. The loss is estimated at $175,000.

The Supreme Court at Indianapolis, Ind., on February 1, decided against boycotts, holding that a conspiracy formed to prevent the carrying out of any lawful business is in restraint of trade and unlawful.

M. B. Ridgeway, of Minneapolis, has planned to build an electric railway between that city, St. Paul and Superior and Duluth, the motive force to be derived from the water-powers along the proposed route.

The Brockton, Mass., Street Railway Company will begin, as soon as the frost is out of the ground, to construct three roads—one to Bridgewater by way of West Bridgewater, another to Elmswood through East Bridgewater, and another to Stoughton.

A measure has been introduced in the Senate by Mr. Rea and in the House by Mr. Stuntz to require electric railway companies using the trolley system to vestibule their cars. The measure is before the Senate committee on railroads and the House committee on labor.

The initiatory step looking to the conversion of the Ohio canals into electric waterways has been taken in the General Assembly. Mr. Harschbarger offered a resolution providing that a committee consisting of five members of the House be appointed to ascertain the approximate cost per mile of waterway of an electric plant of sufficient power and extent to propel canal boats when equipped with the proper electric appliances. The plan proposed is to be modeled after the recent experiments on the Erie canal, near Rochester, N. Y.

The General Electric Works Resume Operations.

The General Electric Works at Schenectady, N. Y., resumed operations on full time on February 5, after a period of reduced working hours which has extended over several months. When the seven o'clock whistle sounded a large crowd of men, eager to secure employment, had assembled at the entrance to the works. A limited number of these were placed at work. General Manager Kreusi said that the force would be gradually increased in accordance with the demands, and that preference would be given to former employés of the company.

A Definition of Steam.

"Jim, wot is steam, anyhow?"

"It's a sort o' waporous sweat wot the millions of hanimalcula wot's in the water throws off in their hanguish at bein' scalded to death!"

"Wot a gilly I am! I might ha' knowed as much."—*Life*.

The city council of Annapolis, Md., has appropriated $100 for plans for an electric light plant for the city.

Air-Core Transformers.

BY FREDERICK BEDELL AND ALBERT C. CREHORE.

In a paper on "The Behavior of an Air-Core Transformer when the Frequency is Below a Certain Critical Value," read before the Physical Society, October 27, 1893, Mr. E. C. Rimington has called attention to the case in which the primary current of a transformer falls off when the secondary is closed. This phenomenon was noted by us last Spring and attention called to it in the *Electrical World*, June 17, 1893, in Article V, on the "Theory of the Transformer," where a curve is drawn (Figure 14), showing the value of the primary current for different loads. We have not yet seen the full text of Mr. Rimington's paper, but, from various references to it, would infer that much of the same ground has been covered by him as was given by us in a paper before the Electrical Congress in Chicago, last August, entitled "General Discussion of the Current Flow in Two Mutually Related Circuits Contained Capacity," printed in full in the *Physical Review* for September and October, 1893. In a more recent communication Mr. Rimington calls attention to the fact that Mr. Kennelly, in an article entitled "The Impedance of Mutually Inductive Circuits," covered some of the same ground as given by him in his paper before the Physical Society above referred to. In a geometrical treatment of the same subject, "Theory of the Transformer VIII," *Electrical World*, Nov. 25, we showed the identity between analytical and graphic methods of solution, including that of Mr. Kennelly, and showed that the whole is deniable from the results given in the paper above referred to presented by us before the Electrical Congress.

This decrease in the primary current of the transformer as the load increases, where the constants of the transformer have certain particular values, is certainly an interesting one, although the amount of increase would always be small. Although the transformer has been the subject of a great deal of discussion, and its theory has been approached from all sides, and the instrument experimented upon by many different methods, it is still a fruitful source of study to the theorist and experimenter, and there is still room for the discovery of many facts interesting and unique.

January 30, 1894.

Young Men's Institute.

One of the most useful branches of study conducted by the Young Men's Institute, 222 and 224 Bowery, New York, is that of electricity. Young men in various positions connected with electrical pursuits find in the instruction given that which helps them in their everyday work or fits them for promotion or both. Many are glad to have the privileges of this class, and it is well filled with bright and enthusiastic men, among whom are found superintendents of electrical works, machinists, engineers, men tending motors and dynamos from the electric railroads, the telegraph and telephone companies, etc. The instruction given by the teacher, Mr. R. H. Mansfield, is thorough and well adapted to those who attend his lectures, which are given twice a week. There has been an enrollment this year of 50 men. The text book used treats of the topics of the most practical value to those beginning this study. From time to time special lectures with experiments are given by expert electricians on different phases of electrical application. Although this is only the second year for this class, the managers of the institute are well pleased with the success which has attended their efforts in this direction.

The City of Brooklyn, N. Y., is paying 50 cents a night for electric street lights at present, but Mayor Schieren thinks that not more than 35 cents a night should be paid. All the bids put in by the companies in December have been rejected by the aldermen, and a new advertisement has been ordered. It is expected that new bids will be made at lower figures.

The New Telephone Exchange at Paris.

POINTERS FOR NEW TELEPHONE EXCHANGE PROMOTERS—THE MULTIPLE SWITCHBOARD—METALLIC CIRCUITS—GROUNDED LINES.

In the last two numbers for December of *L'Electricien*, M. Em. Dieudonne gives a detailed description not only of the new telephone building in the Rue Gutenberg, Paris, but also of the entire telephone installation. Although the description of the building, designed by M. Boussard, may well claim

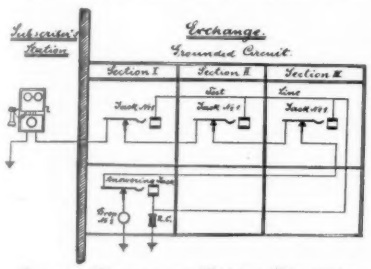

FIG. 1.—METHOD OF WIRING MULTIPLE SWITCHBOARD.

the attention of the American telephone engineers, it is not of sufficient interest to the majority of the readers of the ELECTRICAL REVIEW, and for this reason we shall not enter here upon this part of M. Dieudonne's paper. Up to the present the telephone service of the French metropolis has been performed by 12 separate exchanges; in the new arrangement eight will be abandoned. The remaining four exchanges are located as follows:

A main exchange, capacity 6,000 subscribers, serving Paris proper on Rue Gutenberg.

A second exchange on Wagram avenue, capacity 3,000 subscribers, is being constructed with branches reaching Batignolles and Passy.

The third exchange, known as the Bellevue Office, capacity 6,000 subscribers, includes La Villette, Belleville and the neighboring districts. Lastly, there is to be constructed an exchange on the left bank of the Seine.

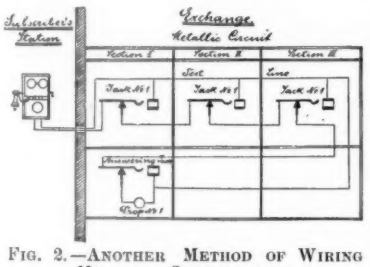

FIG. 2.—ANOTHER METHOD OF WIRING MULTIPLE SWITCHBOARD.

It may be well to allude here to the facts that the telephone service of Paris up to the time the administration decided to buy up the several corporations, conducting the telephone business, was quite unsatisfactory. The year 1889 marks a change, and a decided one, in the French telephone service. After a careful survey of the then existing condition of affairs, the government concluded to introduce that form of switchboard, generally known as the multiple board, manufactured by the Western Electric Company, of Chicago, Ill.

In order to grasp the principles underlying the modern multiple switchboard, it should be remembered that each subscriber's line, in addition to being led to its own section, is multipled throughout the others. For instance, line 1, on entering the exchange, goes first to a springjack (which may be on the first section of the board and bears the corresponding number); it is then led to

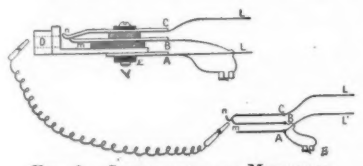

FIG. 3.—SPRINGJACK ON METALLIC CIRCUIT.

another springjack on every consecutive section of the board; in other words, it is multipled; but the main conductor of line 1, after having passed the springjack situated on the last section of the board, is returned to the first section, where it passes through a springjack called the "answering jack," and is then connected with one terminal of the "individual annunciator" of line No 1, the other terminal being joined either to the return conductors, if a metallic circuit, or to ground.

The subjoined drawings, Figs. 1 and 2, clearly show both methods of wiring.

The switchboard placed in the new central telephone office by the Society of Telephone Supplies has a capacity of 6,000 subscribers.

Examining Fig. 3 it will be seen that for every line there are two conductors L L', one of them (the line wire proper) being soldered to a spring C*n*, which normally rests upon a back contact B*m*, while L' is attached to the flat spring A, which is in metallic contact with the tube D. This tube is really a socket having a cylindrical bore in its front part. It terminates in a flat piece of metal on which the contact springs B and C rest, separated, however, by hard rubber sheets, which in turn are fastened by a cylindrical pin V, which, by means of a hard rubber bushing, is completely insulated from all metallic portions of the springjack. Springs B and A connect with an annunciator.

Considering first the plug used with the new multiple board, it consists of a central iron core to which one of the pair of flexible cord conductors is connected. The central core is then covered with an insulating sleeve, which separates it from a brass tube to which the second conductor of the flexible cord is fastened. A pair of plugs and cords are necessary to establish connection between two subscribers.

In an exchange employing grounded circuits the method of wiring is as follows (see Fig. 4): Upon entering the switchboard, line L is led to spring *c;* it is continued by *b* to the spring jack at the next section, c_2 b_2, and so on to c_3 b_3, terminating in the individual jack of the subscriber c_1 b_1 whence it passes through the individual drop *e*, and to ground. It will be noticed that every jack is provided with a metal ring, insulated from the body of the jack and from the springs. These rings are called "test rings."

The test rings of jacks a_1 a_2 a_3 a_1 belonging to line L are connected with each other. There is also a second line L', similar in every respect to line L. Let a'_1 b'_1 c'_1 represent a springjack on the first section of the board; a'_2 b'_2 c'_2, a'_3 b'_3 c'_3, etc., springjacks of sections 2 and 3, connected to and representing line L'; a'_1 b'_1 c'_1 is the answering jack of line L'.

In other words, each subscriber's line has its own answering jack, and each passes through every consecutive section of the board, or, as we have said before, every line is multipled throughout every section.

And now a subscriber rings up Central. His individual drop *e* is energized, the shutter falls, exposing the number. The operator lifts up plug *f* (see diagram, Fig. 5) and pushes it into the answering jack a_1 b_1 c_1 of the calling subscriber. Connection being established, the operator asks for the order. The subscriber states his request. As we explained above how every subscriber's line is within reach of the operator, the latter is not obliged to leave his place in order to answer any call or to make connections; he simply pushes the second plug *f'* in the jack of the called-for subscriber, and the two lines L and L' are inter-connected.

If the line of the called-for subscriber is free, the process of connecting two lines is as described, but if the line called for is busy, the act of introducing the second plug into the springjack of the line called for would either interrupt an already established connection, or cut in a third and undesired party. It is clearly necessary to avoid such annoyance; in fact the operator must be enabled, before making the desired connection, to ascertain whether or not a line is unoccupied. This is done in a simple and ingenious way (Fig. 4). Before pushing the second plug into the springjack of the called-for subscriber, the operator touches with the tip of the "test plug," the so-called "test ring" of the desired line. If the line is free the test rings a'_1 a'_2 a'_3 are completely cut off from any electrical connection with the test battery.

In this case the current from battery P, which traverses the circuit of T, the receiver, L, the inductorium, *i r d c f* and line L, suffers no change; consequently, there can be no inductive phenomenon in the helix of the telephone T; it remains silent.

On the other hand, assume the line is occupied, as soon as a plug is inserted into a certain jack, say, a'_3 b'_3 c'_3, then the test rings of the corresponding jacks are connected through the shank of the plug, while the tip is connected with spring c'_3, and thus with line L', and the ground at the subscriber's station. In this case the current passes through the circuit *d c f* a'_3 c'_3 and the line L'; it changes its strength in the branch T I *i r*, the change causing a sharp click in the receiver. The operator is thus informed that the line is busy and so notifies the subscriber. This is the so-called "busy test."

There is no change in the arrangement of jacks in multiple boards wired for metallic circuits; in each case the rings are connected to the return conductor, or second wire, and this wire is also connected with one terminal of the drop. The diagram, Fig. 6, illustrates the mode of connecting two subscribers. When a subscriber calls, the operator inserts plug *f f*$_1$ of one pair of cords into the jack of the calling subscriber, presses the listening key E upon *i*–*i*'–i_1. The circuit of the subscriber's microphone

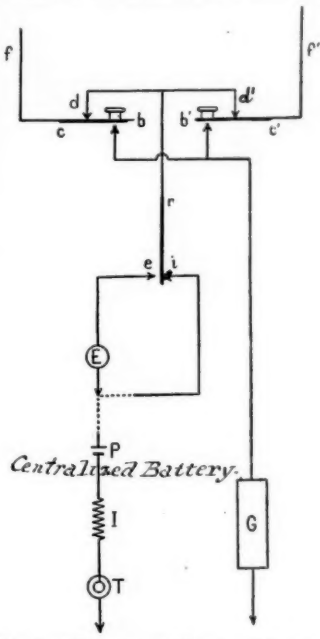

FIG. 5.—METHOD OF MAKING CONNECTION.

is thus closed across the exchange *f*, *a*, *r*, i_1, C, I, T, I, *i*, *m*, *d*, *c* and f_1.

In the drawing only the ends of the plugs are shown. It will be seen that the central core is connected with one of the flexible conductors, and is insulated from the other by the sleeve to which the second conductor is attached.

When the subscriber has given his order, the operator makes the busy test before connecting up the subscriber called for. To effect this, she touches the test ring of the subscriber called with the central pin *f'* of the plug *f f'*. If this line is free the telephone T is silent and the operator inserts the plug, and the two subscribers are interconnected.

If the line is busy, that is to say, if a plug is at some point in a jack, this plug at another section of the line, by means of the exterior ring, places the test rings of the jacks in circuit with a system such as R P, which includes a choking coil R and a battery P. The contact of the plug with one of these test rings introduces one convolution of the telephone T in the circuit of *g*, *h*, *k*, i_1, I and grounds the current, which causes the receiver to give a click; then the operator stops and informs the caller that the line of the subscriber for whom he asks is busy. We understand the use of condensers has been introduced into telephone by Van Rysselberghe. It is used here to prevent the current from being shunted over *i*, *r*, *f*. The work of the operator is thus reduced to a minimum.

There are two kinds of drops in a board. First, the individual drop, which is out of circuit during conversation (resistance 100 ohms), and the clearing out drop of 600 to

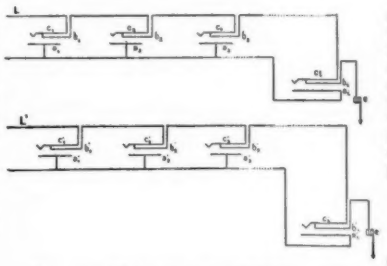

FIG. 4.—METHOD OF WIRING FOR GROUNDED CIRCUIT.

700 ohms resistance, shunted or bridged during a conversation between the two main conductors.

It will be noticed that the secondary of the inductorium I I', similarly that of the receiver is made in the form of a split coil, so that the resistances on both sides of the main conductors are equalized as much as possible. This arrangement prevents undesired noises in the operator's telephone.

The switchboard in the new central consists of 23 large sections, each having 240 subscribers, two switching sections for city lines, 10 sections for representing the other telephone exchange of Paris, and three sections for suburban lines; a grand total of 38 sections.

More than a million solderings were required to connect the wires with the apparatus. The subscribers' jacks, arranged in hundreds, occupy the upper portion of the panels, and they are duplicated in each section.

The outgoing trunk lines are used for calling up the other Paris exchanges. The jacks belonging to such trunk lines are also multiples throughout every section and form a single row. Likewise the jacks used only for the work of the exchange are multipled and in a single row. On the other hand, the subscribers' jacks form a number of rows, generally two, in each section and occupy the lower part.

The plugs are fixed vertically in their place, immediately below the individual jacks. Two plugs with their appropriate cords form a pair, one plug standing behind the other. The flexible cords are held taut by a weight, as is well known. In making a connection the operator takes up first the rear plug of a pair and places this in the jack of the calling subscriber and having pressed down his listening key, which throws the telephone into circuit, receives the order. He then tests the line demanded by touching its test ring with the tip of the yet unused plug.

The calling drops are arranged in five rows at the base of the several sections, and each one is connected to an individual or subscriber's jack, the number of the drop corresponding with the number of the subscriber.

Directly above the subscribers' drops is a row of clearing out drops; these are connected with the operator's outfit, as clearly shown in Fig. 6.

On the new board the clearing out drops are situated in front of the listening and ringing keys. It should also be noted that each listening key and pair of buttons facing it is connected to the pair of opposite plugs.

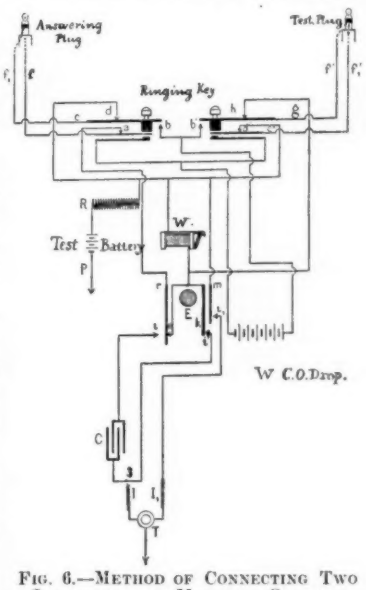

FIG. 6.—METHOD OF CONNECTING TWO SUBSCRIBERS ON METALLIC CIRCUITS.

The usual adjustable transmitters and head telephones are employed.

There are also supervising desks in the office and means for quickly testing the condition of lines and ascertaining troubles.

In conclusion, it should be stated that since the introduction of the multiple boards the telephone service of Paris has much improved and the general adoption of multiple switchboards for all French telephone exchanges is merely a matter of time and the necessary funds. Given the proper working apparatus there is no doubt that at the end of 1894 the increase in subscribers will be greatly in advance of that of any of the preceding years.

Decisions in Two Important Suits.

Judge Coxe, on January 26, rendered two important decisions. In the case of the Edison Electric Light Company *vs.* the F. P. Little Electric Construction and Supply Company, of Buffalo, N. Y., in which the latter were sued for infringement in system of wiring used at the Binghamton state hospital, motion for a preliminary injunction was denied, the defendants to give a bond for damages to be assessed if infringement is finally proved.

In the case of the Edison Company *vs.* the E. G. Bernard Company, of Troy, N. Y., based on similar grounds and known as the Watervliet arsenal case, the injunction was granted, the court holding that infringement was established as to some of the consumption circuits.

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Talk is cheaper than ever before.

Business is rapidly getting better. This is especially true of electric construction.

A new car brake, which will be of interest to electric railway managers, will soon be tried on one of the Broadway cable cars in New York city.

The incandescent lamp inventor is still hard at work. We are informed that several new non-infringing types will soon be ready for inspection.

We commend to our readers a thoughtful and interesting character sketch of Nikola Tesla, by Thomas Commerford Martin, which appears in the February number of the *Century* magazine.

We expect to see the largest attendance at Washington that has ever been present at an electric light convention. Street railway men, as well as central station managers, will find a great deal of interest to them at this meeting.

RAPID TRANSIT IN NEW YORK CITY.

We wonder what is the feeling which strikes the inner consciousness of the rapid transit commissioner when he indulges in a little retrospection; when he comes to the reflection that several years of most valuable time have passed and over a hundred thousand dollars spent for what must in truth be set down as nothing at all? What on earth were these commissioners created for, if not to consider the various methods, select the best and then give us what they were appointed to give—real rapid transit? What is the use of all this absurd red-tape—tape which binds bundles of vacuous minutes of proceedings of no value or real purpose? Why cannot a legislative commission of supposedly representative business men conduct the matter in hand, just as they would in consulting about some momentous proposition in their own every-day business?

The firm of Smith, Jones & Company has located its immense works a bit awkwardly—a couple of miles from a railroad trunk line—and the firm realizes the heavy charge and inconvenience of trucking everything to and from the railroad. Finally, one suggests building a track from the works to the railroad, the executives of the firm meet, talk it over and appoint one member to look up the question of cost and results. But they don't hob-nob for numberless tiresome *seances* for newspaper effect. They go at it in a business way and appoint a day, perhaps one or two weeks later, for final consideration of the matter. Meantime, the one appointed gets one or two estimates for one or two available routes, tabulates his conclusions, presents them at the next meeting and inside 30 days the work is under way. There is no red-tape here, but all prompt incisive business energy concentrated on the one object in hand.

But this commission of ours would collapse at the idea of settling our rapid transit in such unseemly fashion. The old Knickerbocker lymph still floats sluggishly through its system, and rapid transit is inconsistent with its mode of life and thought and action. The best thing to do would be to discontinue it forthwith, and appoint a commission of men who would have some activity and decision. It would be the kindest thing to do, too, for the existing commission will die of dry rot if not soon transplanted.

When the Broadway Railway Company took up the question of cabling its road, there was prompt decision put into action. A thoroughly competent engineer was appointed, he and the executive committee went to work, not to sleep, and the city is to-day millions of dollars better off for having so fine a cable system on its main thoroughfare. But such haste would never do for our commissioners.

The underground tunnel, they know full well, every man of them, is the only system of actual rapid transit between the Battery and Harlem. But there might be some trouble at Canal street with sewage or even tide-water, there might be a quicksand feared near the Post Office, there might be a threatened rift to the trunk of the sewer at this point or that; therefore, our commission must postpone everything and take testimony on all these points. They cannot decide, because they have not backbone enough among the lot to furnish even a medium-sized eel.

If the right kind of a commission cannot be found, it would be quite as effective, if not after all the best thing, to make the rapid transit affair a municipal undertaking. Advertise for plans on the competitive basis, paying a good price for the best plans, with the grand prize of adoption for the most worthy plan, and then go ahead and construct, the work being done under the direct supervision of the engineer who made the successful plans. There are many engineers in this country perfectly able to design and construct a completely practicable system of underground transit for this city. A fair percentage allowance on the cost, or a good lump sum, would be a sufficient incentive for them to bring out their plans. The mechanical and constructing engineer could easily be found, competent to lay out the construction of the underground works, approaches, stations, etc., and the electrical engineers of our own community are impatient for an opportunity to get to work on the transportation part of the problem. Give them the tunnel and they will guarantee the rest. We do not hesitate to say that there would be no difficulty whatever, so far as speed is concerned, in sending express trains from the Battery to the Harlem in 12 minutes. Electricity must be the motive power of course.

As to the municipality owning the road, why in the world should it not? People have said politics will enter and make its operation cost 50 per cent. more than under private capital. Suppose that is true. What then? With good management the system could be operated easily on a basis of 60 per cent. of gross earnings, or even better. Now, let politics step in, and let the cost of operation rise 50 per cent. above the previous figure. There would still be no loss, but there would be plenty of room for an actual profit, after paying interest. But even if no profit came from it directly, there would be a grand harvest for the city in other respects. The people would be accommodated, the city would be enriched by increased valuations by hundreds of millions of dollars in a few years, and room would be made for double the present population.

If we look dispassionately at the whole question, the feeling grows that perhaps the quickest and the very best way to secure real rapid transit is to take the bull by the horns, make a municipal affair entirely of the tunnel system, and submit to the trifling objectionable features of politics, Tammanyism, nepotism, etc., in order to obtain the overwhelming advantages which would fall to the lot of this great community by the successful carrying out of rapid transit as it should be.

That offer of a $50,000 prize by the Metropolitan Traction Company, of New York, for a practical street railway system to supersede the trolley and the cable, is stirring up considerable excitement among inventors. It will doubtless take longer to examine all the schemes submitted in competition than it did to invent them. We are told that when the West End Street Railway Company, of Boston, asked for a suitable life guard for trolley cars, over 300 models and 2,000 designs were sent in. It required a year to examine and pass upon them. The man who invents such a system as the Metropolitan Company specifies can get $1,000,000 for it just as easily as he can $50,000.

CORRESPONDENCE.

OUR WESTERN LETTER.

Mr. R. J. Randolph, the Western agent of the Excelsior Electric Company, is already demonstrating to "the boys" that he is back on the old stamping ground and after gore in the shape of orders at healthy prices.

Explosions.—Nine conduit man-hole explosions have occurred during the last week. One man, injured some months ago by a flame bursting from a man-hole, has been awarded $15,000 damages by an indulgent jury.

An Odd Accident.—As two trains were passing on the Alley "L," last Tuesday evening, the foundation of the structure gave way and lowered train, rails and ties nearly two feet. Fortunately both trains were running at slow speed and no great harm resulted.

"It's a Busy Place."—This is the remark of a business man commenting on the number of customers he has always noticed in the warerooms of the Central Electric Company. Its trade is constantly growing, and there has been no complaint of dull times during the last few months.

Mr. Carl Kammeyer has secured the appointment of Western editor and manager of the *Electrical Engineer*, and is already hustling after business. Mr. Kammeyer is well known to the electrical fraternity, among whom he counts many friends who will aid him in his new venture.

To Attend the Washington Convention.—Mr. Wm. H. McKinlock and Mr. John J. Nate expect to represent the Metropolitan Electric Company, at Washington, during the coming convention. The Standard Electric Company, Chicago, will probably be represented at the Washington meeting by Mr. D. P. Perry and Mr. F. E. Drake. This company is sending out half-tone engravings of its multipolar generator and its 50 light arc dynamo.

The Metropolitan Electric Company has learned of some tests recently made in some of the large buildings in Chicago, in which its wire, the N. I. R. insulation, gave excellent results. The N. I. R. factory has enlarged its line of products and is now making electrolier wire, lamp cord, rubber and friction tape, of the same high grade of insulation as their regular wires and cables, which have always been regarded by the trade as first-class in every respect. A full stock of these goods will be carried by the Metropolitan Electric Company, at prices to suit the times.

Street Car Licenses.—The Mayor has instructed the corporation counsel to ascertain if the street car companies cannot be made to pay a larger sum in the way of car license into the city treasury. Under the provision of the ordinance of 1883, a license fee of $50 per car is collected on the basis of 13 round trips daily. Extended lines are now too long to permit of that number of trips daily, and the companies estimate only for cars in actual service, not the number owned, allowing 13 trips to each, whether made or not. Last year the south side lines paid in license fees $22,687; the west side lines, $20,874, and the north side lines, $11,811, a total of $55,572. The companies' receipts were, respectively, $6,059,989, $5,235,633 and $3,014,789, and the net earnings, $2,438,711, $2,342,651, $1,602,033, respectively.

Pneumatic Delivery System.—By a system of pneumatic tubes connecting the various news associations to the main telegraph offices, the City Hall, the City Press Association, and to other points, "copy" is now transmitted to the editorial rooms almost in the turning of the hand, thus eliminating the element of time lost through tardy messengers. Charley Wilson built the system, which consists of 28 vitrified clay pipes surrounded and held in position by a solid wall of cement nearly 12 inches in thickness, the conduit being placed below the other lines of piping in the street. Into these clay ducts special tubes of highly polished brass, having an internal diameter of 2⅞ inches, were drawn and jointed by a tight fitting sleeve, the interior surface being smooth and free of obstructions to the carriers, which are of leather, 2¾ inches in diameter and 8 inches long. The total length of the tubing is 15 miles, and any condensation of moisture therein is absorbed by the Wilson electrical device. The motive power is the Hunter steam jet system.

Chicago, February 10. F. DE L.

OUR BOSTON LETTER.

The Citizens of Nantucket have just closed a four days' session of the annual town meeting, at which the chief subject under discussion was that of street lighting. A strong fight was made to reinstate gas for this purpose, but electricity finally came out ahead, as usual, and last year's contract for electric lighting was renewed.

A Series of Electric Roads, connecting Springfield and Boston, is one of the latest projects to be talked of. As soon as a franchise can be obtained, work will be started on the Wymanha Electric Road, the Connecticut Valley link of what, it is said, will eventually be a great electric railway system between Northampton and Boston.

Meredith, N. H., had quite a celebration the other night in honor of the opening of the new electric light plant. A grand ball and general illumination were part of the programme, and a number of distinguished visitors from different parts of the State were present. The advantages of electricity over oil lamps are evidently appreciated by the citizens of Meredith.

The Cambridge, Mass., Electric Light Company, gave the city a chance to do its own lighting recently by submitting two propositions to the board of aldermen for the sale of its plant, should they decide to operate it under municipal control. The first was to the effect that they would sell all the property and plant, subject to a bonded debt of $200,000 at 6 per cent. due January 1, 1901, and the mortgage given as security therefor, for $308,732.44 cash, the city to assume all obligations and liabilities of the company for existing contracts and rights of way, or to relieve said company from all obligations and liability therefor. The second proposition was that the property and plant could be bought for $533,732.44 free of all debts and encumbrances. The difference of $225,000 between the first and second proposition is based on the present market value of the $200,000 bonds for redemption.

In View of the Great Interest shown at the present time in telephone matters, and the large number of new companies who are about to enter the field, it may be of interest to some of them to gather an idea of the salient features of a bill providing for a telephone commission, drawn by Representative Grover, of Canton, and which has been submitted to the legislature. The bill is exceedingly comprehensive in its make up, and provides for the appointment by the Governor of three telephone commissioners and a clerk. Every telephone company is to make annual returns to the board, setting forth the amount of its capital, its indebtedness and financial condition, and a statement of its income and expenses for the preceding year, together with its dividends paid or declared, and a list of its salaried officers, with the salary paid to each. Every telephone company is to furnish, on request, any statement or information required by the board concerning the management and operation of the company. Said board is to have general supervision of all corporations engaged in the manufacture and sale of telephone instruments and in the operation of telephone lines, and make all necessary inquiries to keep themselves informed as to the compliance of the several corporations with the provisions of the law. On complaint in writing of the Mayor of the city or the selectmen of the town in which a telephone line is in any part operated or located, or of 20 customers of a telephone company, either of the character and quality of the service, or of the price for the use of telephone instruments, or of messages sent by telephone, the board shall notify the company of such complaint and give a public hearing, and after such hearing may order, if they deem just and proper, any reduction in the price for the use of telephone instruments or improvement in the quality of service, or may order any reduction in the price of messages sent by telephone, and they shall pass such orders and take such action as is necessary; and if any telephone company neglects to comply with an order of the board, the Attorney-General may be notified, and any court having equity jurisdiction may, on application of the board, enter a decree to enforce the provisions of the act. In talking over the general features of the bill with a prominent telephone man of Boston to-day, he expressed himself as little concerned about it one way or the other, as, while it is rather an arbitrary measure in its present form, the matter of its being constitutional even is liable to be questioned, and in any event it will be subjected to very material modifications. H. G. T.

Boston, February 10.

PERSONAL.

Lieut. Francis B. Badt, Chicago manager of the power and mining departments of the General Electric Company, has tendered his resignation to take effect March 1.

Prof. Elihu Thomson emphatically denies the recent rumors that he would resign from the General Electric Company and start a new electric company of his own.

A notice has been posted in the Thomson-Houston factories at Lynn, Mass., stating that George E. Emmons has been appointed general manager *vice* E. W. Rice, Jr., resigned.

Mr. F. S. Pearson, formerly consulting engineer for the West End Street Railway Company, Boston, has been appointed engineer for the Metropolitan Traction Company, of New York.

It is reported on good authority that Mr. O. T. Crosby, chairman of the manufacturing committee of the General Electric Company, will soon sever his connection with the company.

Alexander Wyness, Jr., has been elected superintendent of the municipal electric light plant at Batavia, N. Y. Mr. Wyness has resigned from a similar position with the Consolidated Gas and Electric Company, of Batavia.

At a meeting of the directors of the General Electric Company held last week J. P. Ord was chosen second vice-president, Gen. B. F. Peach treasurer, Henry W. Darling assistant treasurer and C. G. Smedberg second assistant treasurer. Mr. Ord, as vice-president, will have charge of the treasury, credit and accounting departments. Mr. Peach has been for some time assistant treasurer, and the office of treasurer has been vacant.

Secretary Herbert, on February 6, appointed a Master Electrician at the Brooklyn Navy Yard. There was an examination, on January 23, of 41 applicants for the place, which is in the Department of Equipment. The candidate who was recommended by the board of examination was J. Martin, of New York city. He passed the examination at a percentage of 94.5. He is already an employé of the Department of Equipment, and has been doing the work of an electrician.

Electric Canal Boat Propulsion.

Mr. Joseph Sachs will deliver a lecture, illustrated with lantern slides, on "Electric Canal Boat Propulsion with Special Reference to the Erie Canal" before the New York Electrical Society at Columbia College, Thursday evening, February 15, at eight o'clock.

OBITUARY.

Edward Austin Oothout, a well-known electrical engineer, died at his house, 46 West Ninth street, New York, on February 5.

Wall Street and the Electrical Stock Market.

The week in Wall street was a repetition of the one preceding. Transactions have been professional, limited in amount and spasmodic in nature. The only market of any importance was in the Industrials. The railroad list, with perhaps one or two minor exceptions, were almost entirely neglected. The Industrial stocks were swayed largely by Washington news, and for the most part possessed a rising tendency. The market has grown so professional of late that room traders and scalpers have found the railroad list very unpromising, as it is not susceptible to the violent fluctuations which characterize the Industrial stocks.

Trade reports indicate that the improvement noted last week and the week before has not continued, thereby indicating that it grew out of the immediate necessity of the country. The actual increase in the resumptions of work was disappointingly small. The uncertainty surrounding the tariff question has undoubtedly been a hindering influence. There has been a slight increase in the consumption of iron in January, amounting to 1½ per cent. The consumption is still 42 per cent. less than a year ago. There is a small decrease in the week in the shipment of boots and shoes. Trading has been in low-priced goods. Some slight gain is reported in textile manufactures and cotton goods. Dealers' stocks have held out better than was expected, and among a number of mills there is a prospect of an early closing down.

Western Union was weak throughout the period under review on continued liquidation. The opinion is crystalizing in the Street that the earnings for the current quarter will show a marked falling off. Some even go so far as to say that they will go to a point which will endanger present dividend rate. Last week the stock received support around 84. This support was withdrawn, and the lowest price touched was 81¾ on Friday. There has been considerable talk of Mr. Sage selling out. Mr. George Gould is quoted as saying that he had more Western Union to-day than a year ago. The encroachment of telephone service upon the telegraph is reported to be cutting into Western Union business to an alarming degree. A gentleman in a position to know tells me that the March 31st quarterly report of Western Union will be poor. Gross earnings are falling off about 33 per cent., but net earnings are not so bad comparatively because of economies. He did not believe that the dividend would be reduced, but that if summer business was bad a reduction in dividends will be in order. There were quite heavy transactions in the Collateral Trust 5 per cent. bonds at 103¾ to 103½.

General Electric had its weakest day on Monday, when the stock touched 33½. It was sold on the failure of the Nashville Traction Company, one of its assets. In the latter days of the week it developed considerable strength upon the starting up, full force, of the Schenectady factories. The argument was that the full operation of this plant meant a material improvement in business. The highest and last prices were around 35¾.

The Debenture Fives were active selling from 72 to 73. The preferred stock was quoted at 60 on the Boston Stock Exchange.

Of the less active electrical securities North American ranged between 3⅞ and 4⅛. American Telegraph and Cable sold at 87 on Thursday, and, following the weakness of Western Union, sales were made at 85 on the day following. Edison Electric Illuminating, of N. Y., was not traded in. The first 5 per cent. bonds were sold at 105¼ to 105½.

On the Boston Exchange, Bell Telephone developed considerable weakness, selling down from 175 to 170 bid and 172½ asked. The total number of shares traded in was 578.

Erie Telephone was stronger at about 44. This company will pay its quarterly dividend of one per cent. February 19; books close February 11 and open February 18. The three companies through which the Erie operates—namely, the Cleveland Telephone Company, the Northwestern Telephone Exchange Company and the Southwestern Telegraph and Telephone Company—report for three months, ending December 31, a surplus of $10,005, an increase of $925. From April 1 to December 31 the surplus was $22,377, a decrease of $4,496.

One of the largest stockholders of the Erie company says that he has recently been asked for an option on 2,000 shares of his stock at 50, good for two months, which he declined to give. He says that the Bell company does not own any Erie stock, but does own a minority interest in Erie subcompany, which have absolute and perpetual control of business in the States of Minnesota, the Dakotas, Texas and Arkansas. The Bell company cannot enter into any of these States except by permission of the Erie, which holds majority control.

New York, February 10.

SOME TELEPHONIC DISCUSSION.

AN UNPREJUDICED WRITER'S ATTEMPT TO ANSWER AN IMPRACTICAL QUESTIONER —SOME POINTS WORTHY OF CONSIDERATION.

An inquirer has asked as follows: Will you be kind enough to answer these few questions, which I fear may seem trivial in the eyes of the practical man?

1. Why is a special desk required for a long distance telephonic apparatus, while for an ordinary local line a wall set is sufficient?

2. Why is a telephone, as it now exists, such a cumbersome looking piece of apparatus, and would not a smaller telephone be just as practical?

3. Why are the receivers made so heavy that a long conversation becomes tedious?

4. Why does not the Bell Telephone Company countenance the use of pneumatic earpieces or other devices to render long conversation less tiresome and trying to the ear?

5. Why is there not a directory printed which would be reversible, so as to enable a user to determine the name of a party corresponding to a certain number? This, it would seem to me, would to a great extent prevent mistakes.

Most of these questions voice the sentiments of a number of users, both those who understand the workings of the telephone and those who have not as yet appreciated the beauties and delicacy of this wonderful time and labor saving device. To answer them impartially we must take into consideration the following few facts: A telephone exchange is built and maintained for, primarily, two purposes: for the benefit of the subscribers and of the company who own the plant. Telephones have grown to be of absolute necessity in business, and any business man who may essay to do without one, simply on account of the cost, will shortly find out that he cannot do it. Business methods have changed considerably since the introduction of the telephone exchange system. Dealings have become more rapid, and, therefore, there has necessarily followed a greater amount of business, and consequently more money is made. For these facilities for increasing revenues and for the rapid transaction of business, the users must pay. Few people realize that the greater the number of subscribers to an exchange the greater the number of people they can communicate with, consequently the greater their facilities for the transaction of business and a corresponding increase in expense.

In order to illustrate more clearly, let us deal in extremes. Suppose we have a telephone system with simply a means of communication between A and B. A can converse and communicate only with B and *vice versa*. The cases similar to this are comparatively few, such as a private line from an office to a factory. The communications, to warrant the payment of the sum demanded by the telephone company and getting, therefore, value received, must be frequent and important. The other extreme is where one individual is able to communicate with any one of thousands of subscribers, his conversation being varied and may be in relation to almost any department of business. Of course, the additional value of inter-metropolitan and interurban communication, rendered possible by the long-distance lines, can hardly be estimated. The writer knows of several cases where thousands of dollars have been saved by its use. The telephone may be said to enjoy the distinction of being a necessary luxury, and being such, an adequate compensation must be paid for its privileges. The questions which our inquirer has asked might be considered superficially trivial; but behind them lay facts of much significance. To answer them in order:

First, a desk set is not *required* for long-distance instruments, but is merely furnished by the company as a convenience to its subscribers. The desk portion allowing of a surface upon which communications may be recorded, it serving simply as a writing desk; besides, the whole apparatus is ornamental and possesses a certain amount of individuality and consequent importance, making it respected by the office boy, who is usually prone to undue familiarity in an acquaintanceship of long duration. The advantage of being able to sit while speaking is another point not to be overlooked.

Second, it must be admitted that the telephonic set, as it now is manufactured, is not as compact and neat as it might be. There are telephones in existence, and which are used in parts of Europe, the whole apparatus, transmitter, receiver and bell being not much more than three inches in diameter and about an inch and a half in thickness. The Herz telephone was such an instrument, and the cost of its manufacture was brought to a minimum by having parts made in remote countries, where the cost of labor was very little. Such a telephone could occupy an inconspicuous place, and, as it was exceedingly sensitive, the merest whisper breathed into it was heard as clearly as the loudest sound, which, from a rather ingenious arrangement, could not ruffle the temper of the instrument and cause harsh and grating sounds.

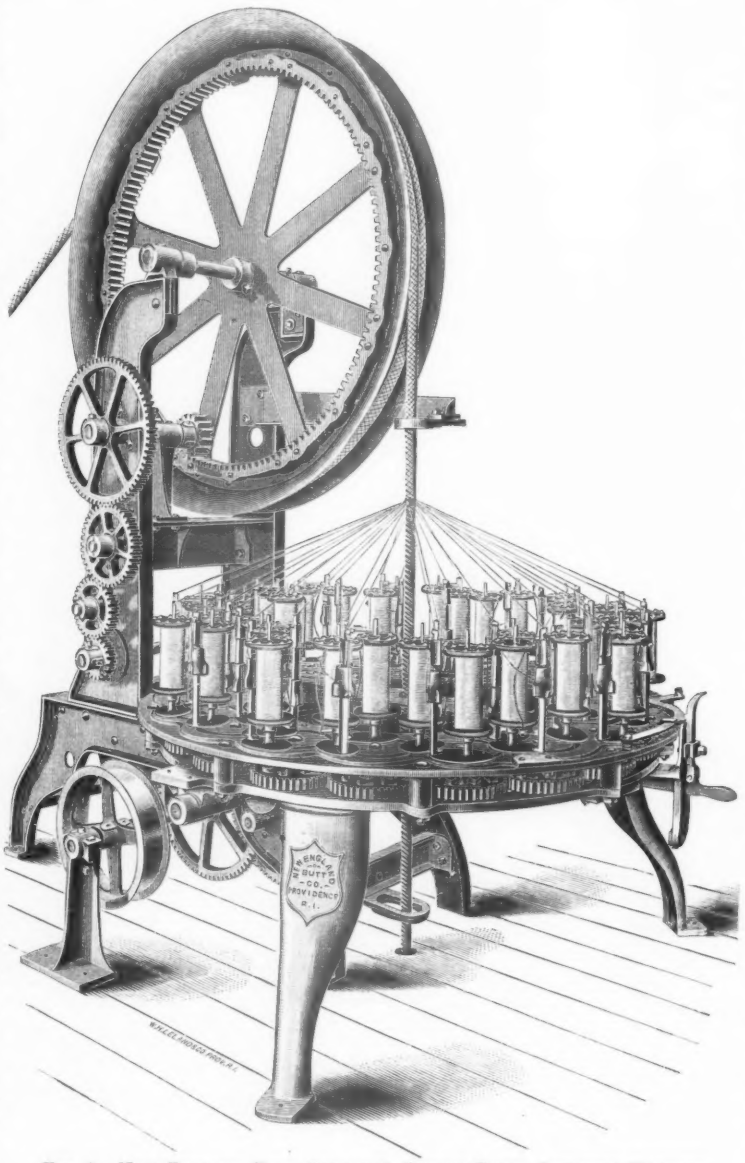


FIG. 2.—NEW ENGLAND BUTT COMPANY'S SINGLE CABLE COVERING MACHINE.

In answer to the next question, we would say that this query must be viewed from two standpoints. First, from that of the telephone company, and second, from the position of the user and the manufacturer, both of whom would benefit by the change. It is a fact beyond question that a smaller and lighter receiver would be more convenient to use and would give just as satisfactory results. As regards this question, an official high in telephone circles said: "Why should we change our receivers? We do not receive many complaints from our subscribers, and the change might cost us a sum well up among the millions. If we were to give lighter receivers to special individuals we would receive complaints from everyone else who knew of it that they were not fairly treated, and we therefore do not wish no start it."

This is a point to be noted by rival telephone companies in their new lines.

The fourth question is not so easy of solution. It is to be presumed in the majority of cases that where a company places a device upon the market, that device is or should be as perfect as they can make it. The Bell Telephone Company, therefore, state that their instruments require no auxiliary apparatus, that they are as practical and efficient as a telephone can be made. It is a fact not to be disputed, however, that a long conversation with the heavy air piece placed against the ear is not what might be termed a pleasure. The ear becomes compressed, and it is with a certain feeling of relief that the receiver is put back upon the hook. A pneumatic ear piece, consisting of a miniature pneumatic tire clamped around the orifice of the receiver, is now being distributed widely through the city by an energetic inventor, and it is remarkable what a relief it is to use them. Instances are known, however, where the company have refused to allow any auxiliary apparatus placed upon their telephones. Whether the company is right or not in taking this stand, it would seem as a question which cannot be easily answered. It might possibly be a better line of action, if we may offer the suggestion, for the company to pass upon some style of pneumatic cushion and thus give their sanction for the use of a meritorious device. This would be in line with the motto, "Live and let live."

In answer to the question, "Why is there not a reversible directory?" we would say that this again will have to be answered from two standpoints, from the telephone companies' and from the subscribers'. While there would be a small saving in trouble to a subscriber, the cost of publishing a telephone directory would be almost doubled.

JULIAN A. MOSES.

An Electric Railroad From Leland Stanford, Jr., University to Palo Alto, Cal.

The *Daily Palo Alto*, a paper published by the students of Leland Stanford, Jr., University, says that the electrical engineering department of the university has a project on foot which will materially affect the the relation of the university to Palo Alto, being nothing less than a proposition to build an electric railroad to that place. Numerous plans have been heretofore suggested by property owners in Mayfield and Palo Alto regarding such a road, but the matter has always fallen through, to the great disgust of those who bought property under such representations. Now it is proposed that the university build and operate the road.

Prof. F. A. C. Perrine has given out specifications for his class to work up in groups of two. The plan is to assign different electrical systems to be reported on at the end of the semester in lieu of theses, when the one best adapted to the situation can be chosen and the details worked up in the same manner by the class. It is thought that by the time the university is in shape to take the construction in hand the detail plans and specifications will be ready.

The engineering and management of construction will be done entirely by the engineering departments of the university. The surveying will be attended to by the civil engineering corps, and the mechanical engineers are to have a share in the work.

As overhead wires would not harmonize well with the architecture of the institution, besides being unsightly in themselves, the endeavor will be to decide between systems in which this feature is eliminated. A storage battery system has been mentioned, as also have a number of conduit systems. One thing is sure, however, whatever the system may be, it will contain such modern features as are most desirable, and will not be out of harmony with the beautiful drives and buildings.

The plant is intended to be owned and run by the university, and will doubtless be a paying investment as well as a great convenience to those who wish to live in Palo Alto and at the same time attend the university recitations and lectures.

New Cable Covering Machines.

The New England Butt Company, of Providence, R. I., whose cable covering machines, No. 2 single and No. 2 double, we illustrate in Figures 1 and 2, are now prepared to furnish to order, in addition to drilled cast burr hinges, hardware specialties and braiding machinery, superior iron castings of every description, patterns for the same. Having a machine shop in full and efficient operation, they are prepared to contract for machinery and other specialties. They have also large annealing furnaces, and are prepared to anneal both iron and steel in the very best manner.

Their No. 2 cable covering machine, with 60 inch wheel take-up, has 36 strands, with bobbins six and one-half inch traverse, four and one-half inch head, weighs three to 20 ounces. The machine is strongly built and is driven by a friction pulley. The feed wheel is driven by a series of gears connecting with an internal gear on its periphery, thus applying the power at the point of greatest leverage and assuring a powerful and steady pull on the cable through the machine

Their No. 2 double cable covering machine, as shown in Fig. 2, is similar to the one before mentioned with the exception that it is 16 and 24 strand.

These machines are remarkably easy of operation, and the company claim that they are unexcelled for the work for which they are intended.

Telephonic Communication Between Scotland and Ireland.

Telephonic communication has recently been established between Hawick, N. B., and Edinburgh, Glasgow and Belfast. The distance between the former and the latter towns is 250 miles.

Street Railways in Massachusetts.

Part II of the Massachusetts Railroad Commissioners' annual report contains reports for the year ending September 30, 1893, from 60 street railway companies—one less than last year.

The commissioners say the electric system has not indicated any such margin of profit as to justify the expectation of more than moderate returns on money legitimately invested in it. The commissioners commend the action of the West End in reducing its dividend, and say it ought to enhance the value of the stock.

The Lynn and Boston and the Lowell, Lawrence and Haverhill companies have absorbed five other companies during the year. These seven companies before the consolidation had capital stock and a net debt of $3,857,140, while the two purchasing companies had on September 30 a total capitalization of $8,580,077, an increase of about 125 per cent. These figures do not include $4,000,000 five per cent. 20 year bonds issued by the Lynn and Boston "to secure" its liabilities.

As the lines of these companies were only increased 12 per cent., or 17 miles to 159 miles and 47 miles electrically equipped, the board is unable to account for a very large fraction of the $4,722,937 increase in capitalization.

Contracts Awarded at Detroit.

At Detroit, Mich., on February 4, Public Lighting Commissioners Jackson, Lothrop, Hudson and Farrand met in executive session, and with City Electrician Dow and Jesse M. Smith, the mechanical expert, took up the proposals for steam and electrical apparatus. They decided to award contracts as follows: Engines, triple expansion, S. F. Hodge, Detroit, $20,000; boilers, Peck double deck with Hawley down draught furnaces, Charles A. Strelinger & Company, Detroit, $31,500; dynamos, eighteen 100-light machines, Western Electric Company, Chicago, $41,250; lamps, double carbon, Brush Electric Company, Cleveland, $41,-969; total, $134,719.

The commission decided to use the double carbon lamps, and awarded the contract in this, as in every instance, to the lowest bidder. Contracts were not actually awarded, because the commission has no money on hand, but as soon as the bond proceeds are available the contracts with these bidders will be transmitted to the council for confirmation.

A New Alternating Arc Lamp.

One of the prominent manufacturers of arc lights for incandescent circuits has recently produced an alternating current lamp. The manufacturer states that, running at 30 volts, it requires but 10 amperes of current, taking 300 watts. The direct-current lamps, operating two in series on a 110 volt circuit for the same amount of light, require each four amperes of current. The light is distributed evenly, and a white porcelain or enameled tin reflector diffuses the intense white light. The humming, too, is so slight as to be hardly noticeable.

Telephonic Communication in Italy.

An important item of news reaches us from Italy. It is that the Minister of Posts and Telegraphs is considering the question of telephonic communication between all the principal towns of the country. It is proposed at first to establish communication between Rome and Naples, between Florence, Pisa and Leghorn, between Turin, Milan and Genoa, and between the suburban districts surrounding all the principal towns. The Belgian system or Van Rysselbergh is said to be the one in contemplation.

Reply to a Kicker.

"Say, you charge me too much for this light," he growled, as he paid the electric company for his last month's account. "Oh, no," smiled the collector; "that's our current price to everyone."—*Detroit Free Press.*

ELECTRIC LIGHT FLASHES.

The municipal electric light plant at North Attleboro, Mass., is to be equal to any in the State, according to those who have the job of putting it in. The town appropriated $50,000 to pay for it, and it will probably be in working order by March 1.

The Amethyst Electric Light and Power Company, of Creede, Col., is again operating its plant, after seven months of idleness. In consequence, the City of Creede will be all ablaze with electric lights, "and there will be no night in Creede," as Cy Warman's poem has it.

By a vote of 63 to 1 the stockholders of the Cincinnati Gas Company have agreed to accept the proposition to increase its capital stock $600,000, which sum represents the capital stock of the Cincinnati Electric Light Company. This action gives each person who holds 20 shares of electric light stock the privilege of exchanging it for one share of gas stock, as the par value of the former is only $5, while $100 is the par value of gas. Electric light stock has been paying six per cent. dividend, while gas pays eight per cent.

The Thomson-Houston works in Lynn, Mass., started up again on February 5, after a week's shut-down to take an inventory of stock. There are now employed in the Lynn works about 1,700 men, and the weekly pay roll is more than $16,000. Before the removal of departments to Schenectady, N.Y., the works gave employment to 4,000 operatives. It is understood that the officers of the Thomson-Houston Company are considering the expediency of consolidating the several departments in Lynn in one or two buildings. It is likely that factories C and L will be thus utilized for most of the work. This would require that these factories be run on full time to do the work now on hand.

The Cambridge, Mass., Electric Light Company has submitted to the board of aldermen of that city a statement of its property and plant, according to the statutes, in case the city should decide to furnish its own lighting. The company makes two propositions: First, it offers to sell all its property and plant (being all the property and assets of the company, except accounts receivable and cash in action)—subject to a bonded debt of $200,000 at six per cent., due January 1, 1901, and the mortgage given as security therefor—for $308,732.44 cash, delivery of the property to be made at the time of payment of the same, the city to assume all obligations and liabilities of the company for existing contracts and rights of way or to relieve said company from all obligations and liability therefor. The second proposition is that the company will sell all of its property and plant, free of all debts and encumbrances, for the sum of $533,732.44. The difference of $225,000 between the first and second proposition is based upon the present market value, as estimated, of said $200,000 bonds for redemption. The communication was placed on file.

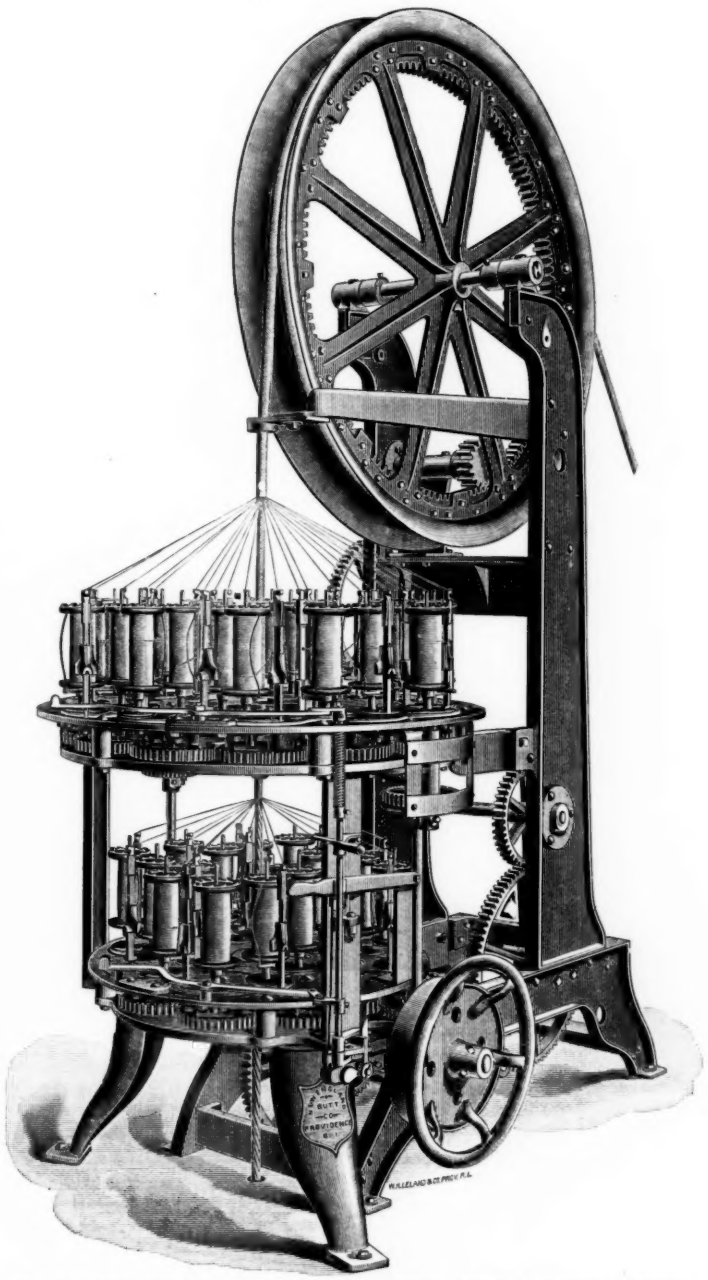


FIG. 1.—NEW ENGLAND BUTT COMPANY'S DOUBLE CABLE COVERING MACHINE.

A New Thermo-Electric Phenomenon.

It is stated in many text-books, and pretty generally known, that electric currents may be produced by heating a single metal, if there be any variation in temper, or if the distribution of heat be very irregular, and the changes of temperature abrupt, says W. Huey Steele, M.A., in *Science*. These effects are generally supposed to be exceedingly small compared with ordinary thermo-electric effects, but some experiments performed by the writer in the Physical Laboratory of the University of Melbourne, show that at high temperatures these effects are sometimes exceedingly large, as great or greater than that given by a junction of antimony and bismuth at the same temperature. At low temperatures this is most apparent in iron wires, iron being the only metal in which I could observe the effect at a temperature below 100 degrees C. If a piece of iron wire be put in circuit with a very sensitive galvanometer and gently heated, irregular currents will flow, sometimes one way, sometimes the other, rising and falling in an apparently arbitrary manner. I several times observed the effect simply by warming the wire with my fingers. At a red heat the effect is much more marked, and also much more irregular. The effect in iron, however, is not so great as in some other metals at a high temperature, the highest effect I observed in it being .002 volt. Altogether, 12 different metals and four alloys were examined and the effect noticed in each of them. In order to raise them to a high temperature without breaking circuit by their fusing, I put them through clay tubes (tobacco pipe stems), and when examining metals with low melting points, I completely filled up the tube with the metal. A tube of lead when heated gave after a little irregular heating, .3 volt, and another, with a lead wire passed through it and heated about the middle, gave about half that amount, but in this case there was no irregular or unsymmetrical heating. The effects are not always steady, in fact they very seldom keep steady, but they may be observed with certainty by filling a tube with lead and raising it to a red heat in a Bunsen flame. The effect may also be observed very easily in fine gold wire, but it does not last so long as that in lead, which shows no sign of ceasing after an hour's or half a day's heating. With gold I observed a higher effect than with any other metal, once observing nearly half a volt. Three-tenths volt was observed with six different metals—lead, copper, gold, tin, zinc and antimony—while with others, *e. g.*, silver and aluminum, though I could certainly observe the effect, it was exceedingly small. Sometimes when a metal is heated thus, the changes in the electro-motive force generated are slow and gradual, and at times scarcely perceptible, while at others they are rapid and sometimes apparently instantaneous, at a time when the temperature is perfectly steady and nothing is apparent which could cause the changes. Another curious effect is that sometimes when the temperature is falling, after the gas has been turned down or put out, there are rises, generally sudden, in the electro motive force; this was chiefly noticed in lead. These phenomena are generally quite sufficient to mask the ordinary thermo-electric effect at a red heat, and thermo-electric tables are consequently unreliable for high temperatures.

A French Rival to the Westinghouse High-Speed Engine.

La Compagnie de Fives-Lille, of Paris, France, is introducing a new system of high-speed engines for the running of dynamos. The engine is of the Westinghouse type. Trials are at present being made by the company on the engine in question.

To Replace Gutta-Percha.

La Societé d'Encouragement pour l'Industrie Nationalè, of Paris, is offering a prize of 600 francs to anyone who will invent or discover a substance which will completely replace gutta-percha in one, at least, of its principal applications.

Alternating Dynamos and Motors and Transformers.

A LECTURE DELIVERED BY DR. LOUIS BELL AT COOPER UNION, JANUARY 22, 1893.

(*Concluded from page 81.*)

But after all this, how about motive power? Lights we can obtain well enough. But suppose we want to obtain power and not lights, or both together? For a good many years the problem of getting power from the alternating current was one on which practical men stuck. No headway was made. Then it occurred to somebody that the alternating dynamo might be run as a motor. In other words, it occurred to somebody that if, by rotating the armature and doing work upon it, you could obtain alternating current, contrariwise, by feeding alternating current into the armature, the same field magnets being employed, the armature ought to be made to rotate; and such was almost immediately found to be the case. The motor in this form is nothing more or less than the alternating current dynamo, something after this form, the poles being north and south alternately throughout the structure. Current sent through a coil here, for example, will be attracted or repelled from the neighboring pole with just as much force as would be sufficient to produce the alternating current in that coil if the machine were used as a dynamo. Suppose this coil is attracted to the north pole, and as it swings by it, the current in it is reversed. It will then be repelled from the north pole, or, what is the same thing, attracted by the south pole; and so the armature will be kept in rotation, the successive impulses of current in opposite directions through these coils keeping step with the progression of the armature from north poles to south all around the field magnet. Such an apparatus was found to work beautifully as a motor—with one exception, it would not start itself. The current passed through it would give a pulse of effort succeeded by another one in the opposite direction and both amounting to nothing. Once get the structure moving, however, so that the alternations of the current fall into step with the sequence of the poles, and it becomes a beautifully efficient motor, possessing the very desirable quality of moving at a perfectly uniform rate of speed, following up the speed of the generator in the most beautiful possible fashion.

It is necessary, however, in order to get this result, that the machine should be brought up to speed so as to fall nicely into step. Once in that condition it is almost impossible to get it out of step, except by tremendous overloading; for, from the magnetic relation of the armature to the field magnets, if there is any tendency for the armature to slip back, slip out of step with the succession of poles, a very much increased current will flow through it automatically, and there will be a consequent attempt to drag it up to speed again. The synchronous alternating motor then, which is what I have just described, furnished a pretty solution for motive power with alternating currents, and is now in considerable use. The synchronous motor keeps up its speed, as I have said, with the greatest ease and exactness; but it won't start itself, and, consequently, there was a great scratching of heads to devise some means of making a machine to get up speed of itself so that it would do useful work. Now, the way was not at all obvious; and one of the first designed solutions of it was gotten at in what is, roughly, the following way, although by a somewhat different train of reasoning, I think.

Suppose we have an alternating motor A. It is represented here with a rudimentary base and bearings. Get it started and up to speed. It will run along at a pace perfectly in step with that of the generator, and then we may utilize it to drive an affair like this, which you recognize as a sort of field magnet, which I have represented here as B. It should have windings upon it traversed by direct current. Now, let us imagine that on this third bearing we have projecting into the interior of this magnet structure another little one, with outwardly pointing poles made, preferably, of laminated iron—simply a cruciform structure such as I showed in one of the forms of alternating dynamo would do. If, now, we started our synchronous motor around, spinning on the armature shaft this magnetic structure, it would drag around with it the laminated mass carried on the outside axis. In other words, supposing our poles here are north and south alternately, as this magnetic structure turns it would take with it the armature inside. Now, it occurred to some one, in fact, to several people at about the same time, that it would be a very nice thing if we could arrange alternating currents so that we could make the poles shift around in the field magnet instead of turning the magnet bodily. If we turned it as in the diagram which I show here, nothing is gained. In fact, we have not as simple a structure as we had before. But if we could take a field magnet with a considerable number of poles, and then make the north poles and south poles shift around, changing their place with relation to the structure, instead of the structure changing its place by rotation in space, we might then be able to drag around the armature precisely as in the first case and so do useful work. That end was accomplished; and it was accomplished by making a structure without very prominent projecting poles and furnished with two sets of windings, one of them making poles, we will say, here, and the next set making poles of corresponding kind in the gaps left by the poles of the first set, so that from the first winding we have a north pole here, and then from the second winding, as the north pole produced by the first dies away, a north pole here, and so on, symmetrically shifting all the poles around the fixed structure, in effect precisely equivalent to rotating the poles themselves. This was done by means of sending into the structures two alternating currents derived generally from the same machine, but so arranged that one should follow up the other. As the north pole produced by the first winding was at its maximum strength, the other would be getting ready to get in its work and to follow up the dying away of the current in the first winding. So the net result was the consecutive shifting of the polar line or lines of this magnetic structure around and around it—a steady procession of north and south pole going around, just exactly as would be the case if we mechanically spun a structure like that shown. And that is the modern *polyphase* system—two phase or three phase in its rudiments. It is simply a device for shifting consecutively and regularly the poles in the field magnet structure, dragging around the armature after them; shifting the poles themselves in the structure rather than turning the structure, and this end can be attained by any number of alternating currents so arranged that each shall come in a little behind the other, keeping up the procession of poles in the different windings all around the structure.

Such a system has a great many very convenient points. It permits very simple and convenient small motors, as well as larger motors of the synchronous type, which are in this case self-starting. This perhaps is the latest development of the old alternating dynamo and alternating system, as first brought into existence 60 years ago and developed practically in the last 20 years.

Just where to look for future advances in alternating current work, it is not altogether easy to determine. Its great value, from a practical standpoint, in contradistinction from the direct current, is the enormous ease with which voltages can be varied. If you want 10,000 volts for the sake of working a long line at comparatively small cost of copper, you can get it simply and cheaply and readily. And if at the other end of the line you want to get five or ten or a thousand volts, anything you please, you can by the simplest sort of an induction arrangement, only a modification of this one shown here, obtain that voltage very economically, and, if you like, vary it again very simply and conveniently. If I wanted to vary the voltage obtained from an arrangement like this (showing transformer coils), for example, I would only have to shift the iron core in it, making the magnetic relations between the two coils worse than it was before. Drawing out the core would very much lessen the effect in induction of one coil upon the other. Replacing the core would bring back the effect. So that if I wanted at one time to get 100 volts from a contrivance of this kind, and again 20 or 30, I could do it simply by shifting the core, and an arrangement which practically amounts to this is in use for electric lights in theatres, where it is desired sometimes to run the lights very faintly, barely a dull red, and again to great brilliancy. The voltage on the alternating mains being kept constant, a mere shifting of the inductive relation between the transformer coils will be quite sufficient to shift the voltage to any amount that is wanted. In fact, it can be done without going to the trouble of using the transformer as such, at all; for it is a fact that passing an alternating current through a coil of this sort cuts down the voltage very noticeably; far more than would be accounted for by the mere resistance of the wire. It cuts down the voltage, owing to an inductive action of each wire on the succeeding wire, which is just as natural and just as real as if the wires were in two separate coils, as they are in an ordinary induction coil.

This discovery that each consecutive turn in a helix of wire has an inductive effect on itself and the next one, was made by Prof. Joseph Henry, one of our countrymen, about the same time that Faraday was engaged on his work. It is what is known as the property of self-induction, and it is put to great practical utility in governing the alternating current. If current be made to pass around a comparatively small number of turns of wire with a good iron core, the voltage will be very much reduced without losing a great deal of energy. It simply amounts to putting in an electro-motive force in opposition to one which is impressed on the coil by the dynamo, so that the self-inductive coil represented by this arrangement can be, and is, used for regulating voltage.

Another advantage of the alternating system, and one not to be sniffed at, is the absence of a commutator on both dynamo and motor, and the substitution for it of nothing more than a couple of smooth collecting rings, or sometimes even a pair of binding posts, as in one of the forms of dynamo which I have shown, wherein all the wire was fixed and from which, consequently, the current could be taken by a pair of binding posts. Anyone who has had anything to do with direct-current machines knows that in them the commutator is the root of all evil, and its absence in alternating current machines is a boon, the value of which can scarcely be overestimated.

Then, finally, the alternating current does give us some possibilities that the direct current, as yet, does not. If we are ever going to get a more efficient means of producing light than that which we have now in the incandescent lamp, the chances are not less than 50 to 1, I should say, that it will be obtained by alternating currents on account of the great flexibility with which we can handle them. The modern incandescent light has an actual efficiency of only about five per cent. That is to say, of the energy put into the lamp and derived from the circuits of the electric company that furnishes it, only about five per cent. appears as light. The rest of it shows up as heat, and in similar forms in which we have no earthly use for it, and the problem which confronts the inventor, perhaps, more than any other to-day, is to devise some means of avoiding this tremendous waste, and in doing that, if it is ever done, I would venture to predict that the alternating current will be, if not the immediate, at least the most potent, agency in the hands of the discoverer. That is only one of the problems that await solution. Just what the next development will be no man can say. But in a very general way you can safely assume that the more easily manipulated, the more flexible the methods of attack which can be brought on any such problem, the nearer the solution will be, and that is why I think it is worth one's while to study and watch carefully the developments in alternating current machinery, not only in the dynamo and the transformer and the motor, but in all the manifold appliances which humanity finds for electrical energy.

OUR CHICAGO LETTER.

The State Asylum at Chester, Ill., secured an appropriation of $1,770 for an extension of its electric light plant.

The Armour Institute and its different departments was fully described in the Chicago *Herald* of Sunday, January 28.

The Heine Safety Boiler Company, of St. Louis, was sued for $20,000 by the Kalamazoo Electric Company for damages on a defective boiler, according to a press dispatch.

President Fuller, of the Excelsior Electric Company, was in Chicago last week, and has placed Mr. R. J. Randolph in charge of the newly opened offices of the Excelsior Electric Company in the Monadnock Block.

New Railway System.—Hardly a day passes but a new conduit or elevated railway system is shown to the directors of the various L roads in Chicago. H. Peterson, of Milwaukee, is one of the late comers, and he proposes to shortly exhibit his model in New York city.

Frederick L. Merrill, The Rookery, is in receipt of a complimentary letter from Geo. F. Durant, general manager of the Bell Telephone Company, of Missouri, reading: "The storage battery plant, installed by you for us in February last, is in continual use and gives entire satisfaction."

Important Changes.—Chicago offices of the General Electric Company may be removed from 173 Adams street to the Monadnock Building, in a few days. The auditing force will be transferred to Schenectady, the understanding being that all who are willing to go will be allowed railway fare and return transportation if not satisfied with their arrangements after arrival there.

One of the Oldest and probably best known commutator conservers on the market is that being sold by the Central Electric Company, and known to the trade as "Gale's." The Central people state that this conserver has been largely used by the central station men for the last five years, and that they know of nothing that has replaced it, and that the demand upon them for this article is steadily increasing.

Goodfellowship.—In Mr. John J. Nate's pocket rests a golden, diamond-studded match-safe, presented to him by the employés of the supply department when he resigned the important position of purchasing agent of the Chicago Telephone Company. This unique and serviceable gift was tendered in a charming presentation speech, in which reference was made to the pleasant relations that had existed for years and to the courtesy and consideration always shown by Mr. Nate to every employé.

Conduit Line.—Efforts are being made to convert the Indiana avenue horse car line into a conduit trolley system. The line is owned by the Chicago City Railway Company, and some of the property owners have held conferences with a view to securing more rapid transit. Mr. A. W. Wright, of Wright & Meysenberg, is quoted as saying that the State street cable line cost $105,000 for a mile of single track. The cost of the conduit system is $37,500 a mile. A trolley honestly built will cost within $10,000 as much. Even Mr. Wright's conduit, shallow as it is, may cost more than $100,000 a mile if the construction force are compelled to move a water main. Compared to the number of pipes encountered in building the down-town line the expenses that may be incurred on this account will be quite small, assuming that the line runs south from Eighteenth street.

Generous Contributors.—The Central Relief Association have received the following contributions, to be expended solely in furnishing work to the unemployed: W. A. Kreidler, $25; Electrician Publishing Company, $25; and $45 from the following staff of the *Western Electrician*: W. F. Collins, $10; J. B. O'Hara, $10; W. E. Kelly, $6; F. L. Perry, $7; J. B. Carney, $5; C. A. Spaulding, $3; Phoebe Fanning, $2; C. W. Forbrich, $2. From the General Electric Company: B. E. Sunny, $25; E. C. Noe, $5; A. R. Searles, $5; Theo. Bailey, $5; W. E. Baker, $3; W. F. White, $3; G. M. Ellis, $2; A. F. Carroll, $2; Blair Thompson, $2; and from 48 other employés, $37.50. In addition to his previous subscription of $15, Mr. E. L. Powers sent in a second check for $5; Walter C. McKinlock, $6.50; Sargent & Lundy, $6.50; C. H. Foster, $13; Kohler Bros., $5; Gustavus Monrath, $3.25.

The Telephone Question.—The Chicago and the Central Union Telephone companies elected the following boards of directors at the annual meeting recently. The Chicago company's directors chosen were: John De Koven, John B. Drake, Arthur G. Fuller, John E. Hudson, J. Russell Jones, Robert T. Lincoln, C. E. Perkins, Henry B. Stone and Norman Williams. The Central Union's new board: C. H. Brownell, R. C. Clowry, C. R. Cummings, Arthur G. Fuller, F. H. Griggs, John E. Hudson, M. G. Kellogg, Henry B. Stone, John F. Willick, Norman Williams and J. Russell Jones. The Central Union has paid five per cent. on $6,250,000 capital stock. On the 22d ult. the stock of the Chicago Telephone Company dropped to 150. Small holders were inclined to sell, but finding ready purchasers, concluded to hold on. Stock paying 24 per cent. on original investment is worth holding in these chilly days. The Western Telephone Company, J. C. Keelyn, president, is endeavoring to secure an ordinance granting it the right to string wires and operate central exchanges in Chicago. The ordinance provided for a rental to regular subscribers for $75 for the first year, $70 for the second and $65 thereafter for the use of telephones. The company also promises to pay five per cent. of its gross receipts to the city and to have its wires underground within seven years from the passage of the ordinance.

F. De L.

Chicago, February 8.

ADVANCE INFORMATION.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies, new telephone companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week.

New Electric Railways.

LONDON, ONT.—The Toronto Street Railway Company has called for tenders for machinery for a new power house. They purpose constructing also 100 new cars. The total estimated expenditure on improvements will be about $1,000,000.

HOLYOKE, MASS.—A new electric street railway company has been organized in this city, under the name of the People's Electric Railway, with a capital of $100,000, to connect South Hadley Falls and Willimansett with Holyoke. The capital stock has all been bought up by citizens. William S. Whiting is the heaviest stockholder.

COLUMBUS, OHIO.—The name of the Sandusky, Milan & Huron Electric Railway Company has been changed to the Sandusky, Milan & Norwalk Electric Railway Company.

MOUNT HOLLY, N. J.—Mount Holly Freight and Passenger Electric Railway, incorporated; capital $15,000. Jacob F. Burroughs.

SLATINGTON, PA.—Street Railway Company has been incorporated with a capital of $30,000.

Electric Light and Power.

OXFORD, N. S.—The Oxford Electric Light Company has been incorporated.

SAN MARCO, TEX.—San Marco Electric Light and Power Company, capital increased to $20,000 for improvements.

GREENVILLE, OHIO.—The Greenville Electric Light and Power Company has been organized with a capital of $15,000.

ST. PAUL, MINN.—The St. Paul Light, Heat and Power Company has filed amended articles of incorporation, fixing the capital at $150,000 and fixing the number of directors at three.

LEWISTOWN, PA.—The Lewistown Electric Light Companay has purchased the Lewistown Gas Works for $10,000.

ORANGE, N. J.—A large company has been formed and is to be known as the Light and Power Company. The purpose will be to furnish light and power to all parts of Essex County and the surrounding districts. The capital is $1,000,000.

HARTFORD, CONN.—The Mather Electric Company has reorganized with the following new directors: Charles E. Perkins, Henry A. Redfield, Thomas C. Perkins, Charles M. Jarvis, J. L. Bunce, Norman G. Crawford and M. S. Chapman. The capital has also been largely increased.

PITTSBURGH, PA.—There was chartered recently the Hazlewood Electric Company, of Pittsburgh; incorporators, T. M. Jenkins, F. C. Kohne, H. O. Hornberger, P. J. Edwards and W. A. Haller, of Pittsburgh. Capital, $20,000.

CHICAGO, ILL.—Superior Light, Heat and Power Company; capital, $50,000; incorporators, F. L. Goulding, L. J. Mosness and A. F. Wright.

PRINCETON, IND.—Princeton Light and Power Company, incorporated; capital, $25,000; Robt. N. Parrett.

STERLING, KANS.—The Electrical Power Company, incorporated; capital, $11,000. J. H. Riekueker.

New Telephone Companies.

ATCHISON, KANS.—The Atchison Telephone and Electric Light Company has been incorporated with a capital of $100,000.

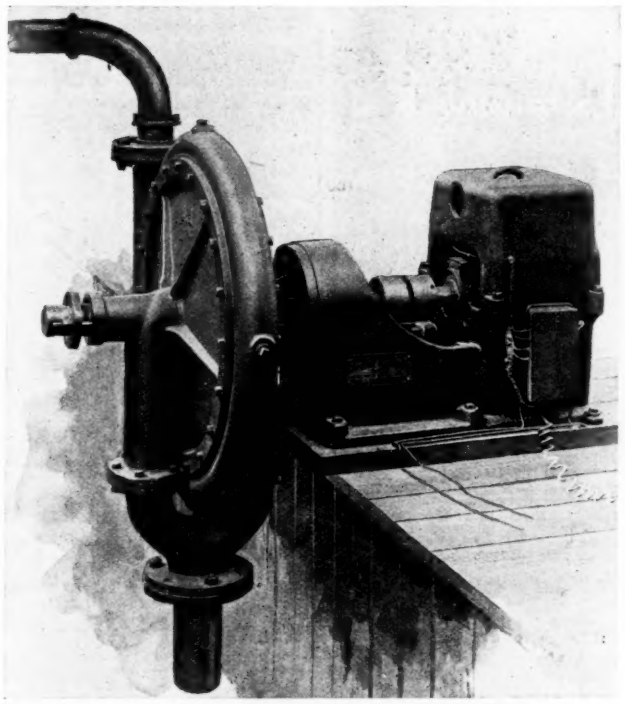
PHILADELPHIA.—A wealthy syndicate has been formed in this city to operate a system of telephones throughout the United States, to be known as the Clamond Telephone Company. The system to be used is now in use in Berlin and London, and is used by the French government in all public departments. Among those interested are Pennsylvania Railroad officials and friends of the Philadelphia Traction Company.

ST. JOSEPH, MO.—The Secretary of State has granted a charter to the Citizens' Telephone Company; capital, $100,000. Incorporators, A. B. Sowdon, M. M. Riggs, J. A. Plotner, O. E. Rumer, J. J. Newell. The object of the organization is to construct, purchase and operate lines of telephones in the State of Missouri.

Increase of Capital.

CHICAGO, ILL.—The Co-operative Electric Light Company has increased its capital stock to $1,000,000.

MASCOMA, N. H.—The Mascoma Gas and Electric Light Company has increased its capital stock to enlarge its business.



GENERAL ELECTRIC COMPANY'S CENTRIFUGAL PUMP.

NEW YORK CITY.—New York Auxiliary Fire Alarm Company, of New York; capital, $30,000. Directors, Richard E. Alexander, of Yonkers; Maurice Maas, Caleb M. Hillman and Horace B. Fry, of New York, and Luther W. Emerson, of Brooklyn.

New Manufacturing Companies.

PORTAND, ME.—The Electrical Annunciator Company has been organized for the purpose of manufacturing and dealing in electrical apparatus, with $500,000 capital, of which $300 is paid in. The officers are: President, E. W. Mann, of Norfolk, Mass.; treasurer, A. C. Allyn, of Rochester, N. Y.

RICHMOND, VA.—Old Dominion Electrical Construction Company, incorporated; capital, $25,000; Maurice W. Thomas, president.

CHICAGO, ILL.—Chicago Electric Truck Company has been incorporated with a capital of $25,000. Incorporators: C. W. Lyman, John Fraser and G. V. Graham.

DAYTON, OHIO.—The Gem Electrical Construction Company has been incorporated by G. B. Butterworth, H. H. Heatman, E. M. Heatman, William F. Breidenbach and H. W. Pleasant; capital, $10,000.

MANSFIELD, OHIO.—The Card Electric Company has been organized with a capital of $100,000.

Business Troubles.

CLEVELAND, OHIO.—Two attachments have been served on the office furniture of the Ford-Washburn Electric Company. One was brought by the W. J. Johnston Company, Limited, for $289.45, due on an advertising bill, and the other by the Electrical Engineer Publishing Company for $33.74, also due for advertising.

An Electric Centrifugal Pump.

Among the many types of electric pumps exhibited by the General Electric Company in its power and mining section at the Chicago Exposition, the electric centrifugal pump, ejecting its broad stream of water into the reservoir in Electricity Building, attracted considerable attention.

The pump itself is a No. 4 four inch centrifugal pump, manufactured by the Lawrence company. The shaft of the pump is directly connected to the shaft of the armature of a General Electric iron clad No. 2 one-half horse-power motor, running at 400 revolutions, at which speed it developed three horse-power.

This pump is intended for use where muddy or dirty water is encountered, which would quickly destroy the usefulness of the valves of an ordinary pump. It is said to have proved remarkably efficient wherever it has been used, especially in raising water for irrigation purposes.

LITERARY.

"First Annual Report of the Board of Electric Light Commissioners of South Norwalk, Conn., for Year Ending October 12, 1893," has been received.

"Annual Report of the Light-House Board to the Secretary of the Treasury for the Fiscal Year Ended June 30, 1893," has been received from the Treasury Department. It contains much matter of electrical interest.

An Up To Date Valve.

The Lunkenheimer Company, Cincinnati, O., have sent out a very convincing little folder graphically illustrating the advantages of the "Lunken" renewable seat gate valve over the old style valves. The folder may be had for the asking.

Ritzville, Washington, now has electric lights.

The Electric Foremen's Association.

The Electric Foremen's Association, composed of employés of the General Electric Company at Lynn, Mass., wound up its existence when the order was given to move the principal departments of the company to Schenectady, N. Y. The funeral obsequies partook of the nature of a wake, and were celebrated at a banquet at the Revere House in Boston, the members coming up from Lynn on the trolley cars. Vice-President Alphabet Fiske occupied the chair, and, after a resolution to disband the association was offered and carried, started the post-prandial ball a-rolling in a brilliant manner.

"We all agree," said Mr. Fiske, "that we are glad to see so many of us here. This is an occasion of some regret, however. It is the last time we contemplate meeting together in this way. The Foremen's Association is no more, and we must give it a respectable wake."

Mr. Fiske thought a priest was necessary in such an event, and happily found one at his side in the person of Edward D. Priest, whom he presented as toastmaster.

Mr. Priest performed the duties of his position with eminent success, and those he called upon for remarks were equally successful.

Prof. Elihu Thomson was the first. "This affair may be the blowout of a fuse which is not replaced," said he. "I have been seeking some compensation for life in Schenectady, and have found it in the fact that you who are to go there may sleep 20 minutes later in the morning than you can here. It is a point to bear in mind, for there are not many such."

E. W. Rice, Jr., followed the professor with "some dying words," as he understood the toastmaster's request.

"If the association is a corpse and dead it ought not to be talking," suggested Mr. Rice, "but though its dissolution has taken place, to my regret, yet I firmly believe there will be a resuscitation some day.

"I cannot believe things will be as dark as they appear now," said the speaker. "We are upon a receding tide at present, but let us all hope for the returning flood to carry us up where we were before.

"There are a great many indications in the signs of returning prosperity that the General Electric will rise again. I believe there is a large future and continued business for the company. If it had not been for the financial depression the company would have had larger contracts, particularly for big work on elevated railways."

Mr. Rice paid a high compliment to the men who were his auditors. He thanked them all for their hearty co-operation, and was sure the success of the company in manufacturing was due to the men around the board.

The last act of the association as it was about to expire was to resolve upon a contribution to the fund for the relief of the unemployed under the "Lynn plan," and a generous sum in money and subscriptions was poured into Secretary Day's hat as the gentlemen sought the coat room.

Injunction Asked Against a Storage Battery Company.

The Brush Electric Company and the Consolidated Electric Storage Company, of New York, as co-complainants, have sued the Electric Storage Battery Company, of Philadelphia, and W. W. Gibbs, president (manufacturers of the chloride accumulator), for infringement, in the United States Circuit Court for the District of New Jersey. The suit is brought on the Brush storage battery patents, recently sustained by the United States Circuit Court of Appeals; more especially Patent No. 337,299. The motion for preliminary injunction will be heard before Judge Green, at Trenton, on the 20th inst.

A foreign contemporary says that it has been noted that when the eyes are illuminated from behind by an incandescent lamp in the mouth, the pupils, seen as blood-red apertures, do not contract.

KINDRED INTERESTS

The Sales Rooms of the Metropolitan Telephone Company at 18 Cortlandt street, N. Y., are full of bustle and activity these days. Requests for telephones come in from all parts of the United States.

J. H. Bunnell & Co., of 74 Cortlandt street, N. Y., are receiving a heavy mail inquiring about telephone supplies. There is much interest in this branch of the electrical business and this reliable house was prompt to recognize it.

The American Electrical Works are now splendidly located in their new factory in East Providence. There is no more successful or ably managed company in the wire business, and President Eugene F. Phillips well merits his pronounced success.

N. S. Large & Son, manufacturers of electrical supplies, 321 Chestnut street, Philadelphia, Pa., have issued an illustrated price list of their electrical specialties, which include a very creditable line of switches, fuse blocks, etc.

C. Rettie, electrical engineer and contractor, 24 Chapel street, Liverpool, England, has sent to the ELECTRICAL REVIEW a calendar printed in colors and showing the various applications of electricity. The electric tramcar on the calendar is operated on the "Thompson-Housten" system.

Okonite is one of the staple insulations, and the energetic company owning it report a constant increase of business. The revival of interest in telephone work, a field in which okonite wires and cables are so widely and popularly known, has brought a rush of orders. In wires for electric lighting and electric railway work the company is also doing a large business.

The Russell Electric Manufacturing Company, 212 Eddy street, Providence, Rhode Island, has issued a neat pamphlet illustrated with snap-shot photographs of their well-known mast arms for arc lights. There are over 2,000 of these mast arms in use at Providence. The pamphlet forms a striking and convincing argument for the merits of this mast arm.

The Joseph Dixon Crucible Company, Jersey City, N. J., have issued the second and revised edition of their valuable book, entitled "Graphite as a Lubricant." The subject is scientifically and practically considered. Prof. R. H. Thurston's special tests on lubricants form the first article in the book. Any reader of the ELECTRICAL REVIEW may have a copy of this valuable work free for the asking.

The Metropolitan Electric Company have taken the general sales agency for the P. & B. specialties, which include paint, armature varnish, electrical compounds, tape and Chatterton's compound. A large stock will be carried at their store and warerooms, 186 8 Fifth ave., Chicago, and prices will be made the same as from the factory. This is a very important arrangement, and the Metropolitan Electric Company are to be congratulated upon securing this agency.

The Dallas Electric Construction Company, electrical engineers and contractors, 106 Akard street, Dallas, Tex., have put in seven mill plants during the past season and have just been awarded the contract for the complete wiring of Cameron mill and elevator at Fort Worth, Tex. They will also supply under this contract a Wood dynamo. This company does all the city and county work and has wired the Dallas City Hall, the calaboose, county court house and jail and the patrol department.

A Chance for American Inventors.

The Netherlands Society for the Promotion of Industry desires to receive papers containing an indication of the means to obtain energy through windmills, to accumulate this energy electrically, and to transmit it, or to make it transportable. The drawings belonging to the answers must be made on white paper (no blue prints) on a scale of one quarter. The prize offered is the gold medal of the society and a reward of £30. Answers must be sent before July 1, with the author's name in a closed envelope, to the general secretary of the society, F. W. Eeden, at Haarlem, Holland.

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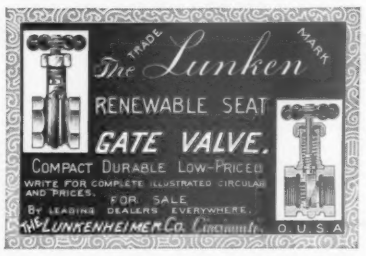
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Good Telephone Books.

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BY THOMAS D. LOCKWOOD.
The Telephone Man's Text Book.
192 Pages. Price, $1.00.

"TELEPHONES, THEIR CONSTRUCTION AND FITTING,"
BY F. C. ALLSOP.
Description of Receivers, Transmitters, Switch Boards, Complete Instrument Switches and Switch Boards, Erecting Telephone Lines, Overhead Wires, Instruments, Connecting, Testing for and removing faults.
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BY W. J. HOPKINS.
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Wire, Insulators, Exchanges, Switch Boards.
The Propagation of Energy.
The Telephone Current.
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Properties of City Lines, Cables, Etc.
Price, $1.50.

"MANUAL OF TELEPHONY,"
BY W. H. PREECE AND ARTHUR T. STUBBS.
Price, $4.50.

"THE ELECTRIC TELEPHONE,"
BY G. B. PRESCOTT.
795 Pages. Price, $6.00.

"THE TELEPHONE,"
BY A. E. DOLBEAR.
Price, 50 Cts.

"THE TELEPHONE, MICROPHONE AND PHONOGRAPH,"
BY COUNT DU MONCEL.
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Chicago Office: Monadnock Building, CLIFT WISE, Manager.

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FRANK RIDLON & CO.
have taken the repair shop formerly occupied by The General Electric Co. at 180 Summer Street, and will repair or furnish duplicate parts of Electrical Apparatus. Please Telephone or Telegraph your order to
FRANK RIDLON & CO., 196 Summer St., Boston, Mass.

THE CITY OF DALLAS.
EXECUTIVE DEPARTMENT,
W. C. CONNOR, Mayor.
Dallas, Texas, January 19, 1894.

Notice to Electric Light Builders.

The City of Dallas, Texas, will receive sealed proposals for the building of an Electric Light plant for the public lighting of the City.

The approximate wants of the City will be as follows:

Arc Lights (double), 2,000 Candle-power, 300.

Incandescent Lights, 30 Candle-power, 1,000, and 80 miles of wire in four circuits, necessary boiler and engine power, poles, etc. Buildings to be furnished by the City.

Bids will also be received to light the City, furnishing 300 Arc and 1,000 Incandescent Lights for a five year contract, to take effect Oct. 1, 1894.

All bids to be received by March 1, 1894.

Address,
GEO. W. CRUTCHER,
City Secretary.

A Suggestion That Everyone Should Heed.

Put your savings in an investment exempt from fluctuation in value and beyond the reach of commercial disaster.

There are no receiverships, reorganizations or repudiations possible in the promise to pay of the *Equitable Life Assurance Society.*

The income of the Equitable last year was $40,286,237.49. Its expense of management was less, its outstanding assurance over one hundred million, and its surplus about double that of the next largest company.

For particulars, address
WALTER H. COOKE,
Manager,
120 BROADWAY, NEW YORK CITY.

Manufacturers of ARC LIGHTING Apparatus for every purpose A SPECIALTY.
CLARK ELECTRIC CO.
192 Broadway, New York.

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SPECIAL ALTERNATING ARC LAMP
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STANDARD ALTERNATING ARC LAMPS
Can be run in multiple from 50 or 100 volt secondary circuits by Spencer Economy Coils.
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NO DEAD RESISTANCE REQUIRED. NO CHANGE OF WIRING.
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Helios Carbons will be sold only with the Helios Lamp. The Helios is the only lamp that has a legal right to use the reflector plate between the standards, without which one-half of the light is wasted.
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Eastern Penn. and Southern N. J. Agency:
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1223 Market St., Philadelphia, Pa.
Southwestern Agents,
ST. LOUIS ELECTRICAL SUPPLY CO.,
St. Louis, Mo.
Canadian Agency, CANADIAN GENERAL ELECTRIC CO., Toronto, Canada.